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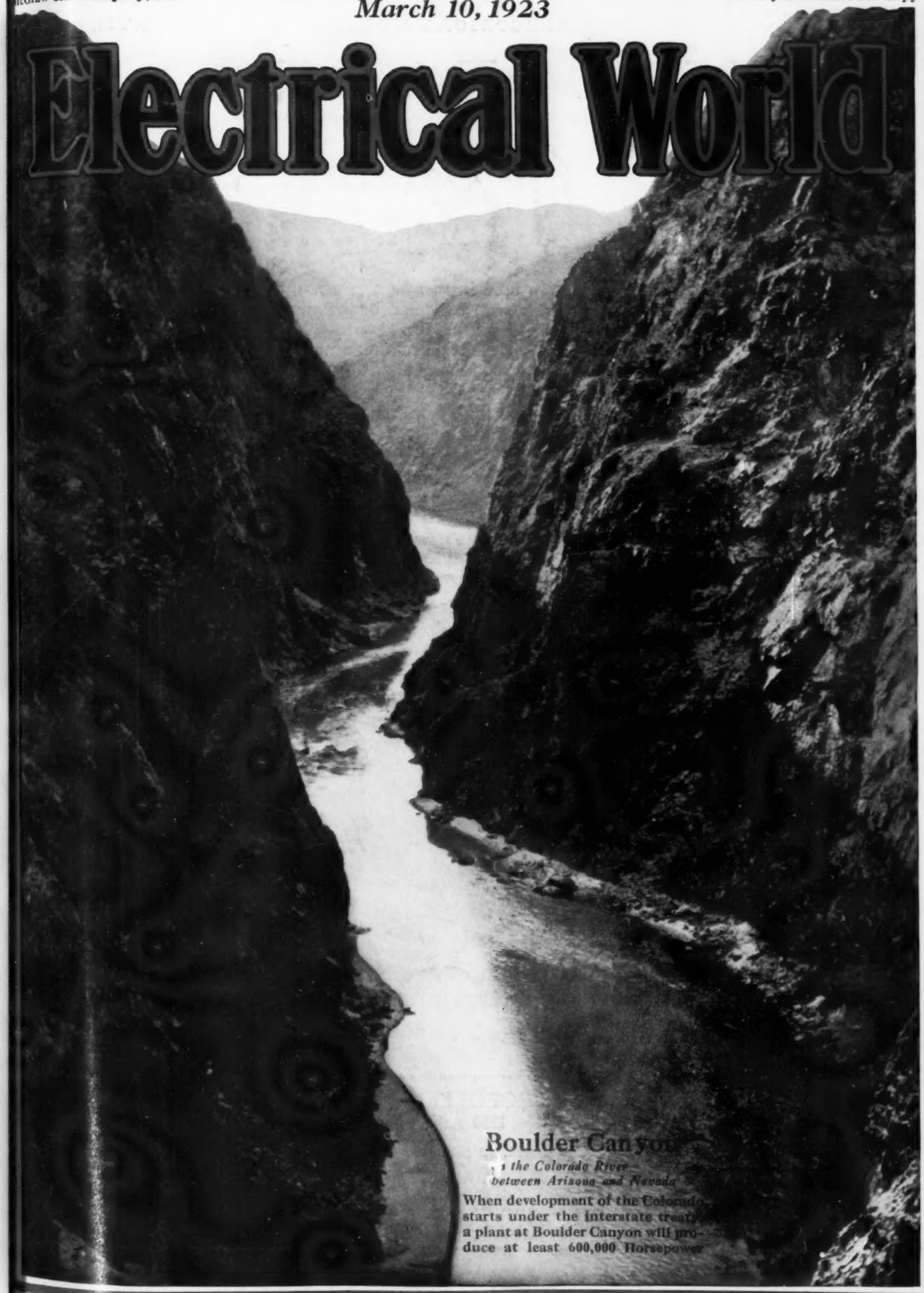

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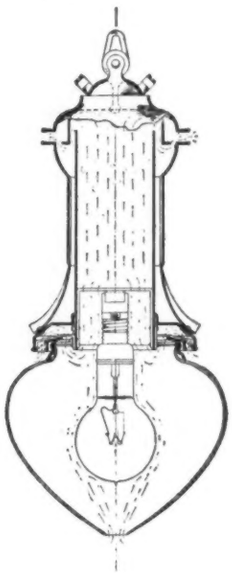

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Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

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W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

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Electricity and Immigration

THE connection between electricity and immigration may seem somewhat nebulous, but it is not at all beyond the bounds of possibility that the electrical industry may prove most effective at least in mitigating, if not in solving, the immigration problem of the country. Electricity has conquered most of the multitudinous tasks which have confronted it; it has gone even further and has been constantly on the alert with untiring and brilliant initiative to devise and create new ways to make life easier and to help material and social progress. Even with this record, the problem of immigration will put the electrical industry on its mettle. Yet if there is any answer to the insistent and growing demand for more cheap hands to perform menial tasks it lies in the further substitution of mechanical appliances and automatic control for human brawn and brain. And electricity is the one agency for motive power and for effective control to make this possible.

IMMIGRATION is a subject which has forced its attention on everyone in this country — whether he is an employer of labor or merely a reader of the daily newspaper. Industry calls for immigrants in large numbers, and the high cost of many things is blamed on the scarcity of low priced men to do the physical work. On the other hand, those who are most concerned over the character of the future American citizens urge more and more restriction on intending immigrants. The recent Congress tried in vain to make some constructive advance on the subject but its efforts came to naught except to incite some intelligent discussion.

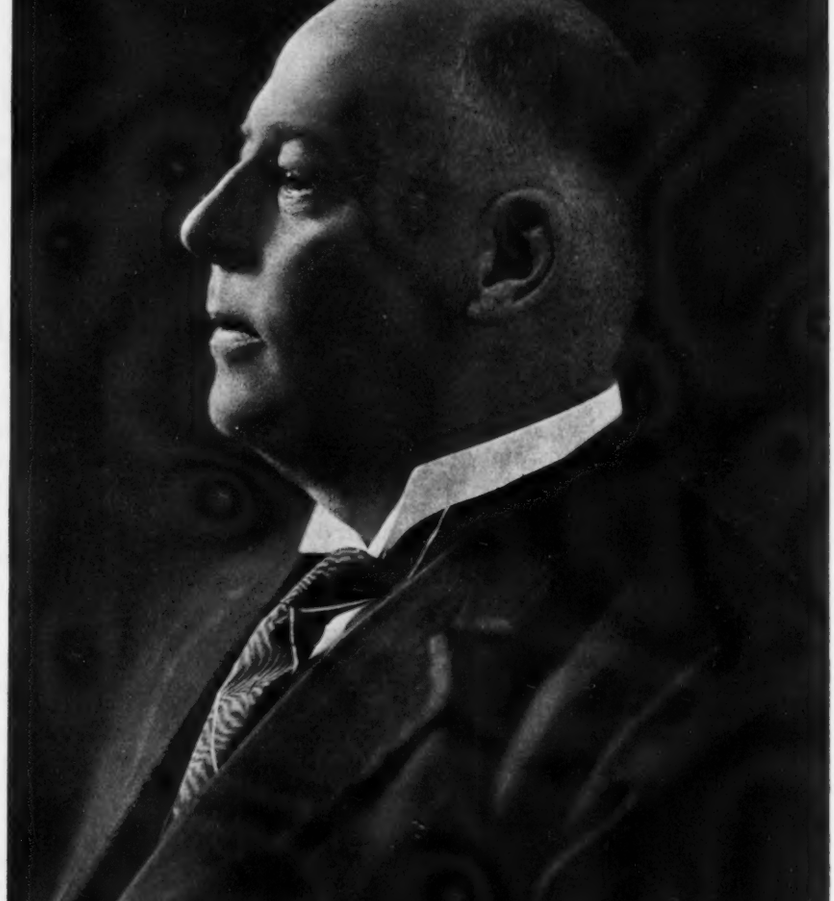
Briefly, as previously pointed out in these columns, here is the story: Immigrants came to this country in desirable numbers and character during the latter half of the last century. Their quality decreased and quantity increased the two decades preceding the war. While common labor came in and helped do the common work, finally, as one noted American has put it, some lumps got into the "melting pot" that we have been unable to melt. The present 3 per cent law based on the 1910 ratio of races is admittedly not the solution. To open the gates creates an Americanization problem the answer to which is not known, the result of which might prove disastrous. To adopt a 2 per cent law based on the 1890 ratio of races, it is held, will give the quality but not the quantity. Some answer is needed which will at once retain American institutions and standards and yet not halt American industry and progress.

AS A NATION we have developed machinery to perform many chores. Electricity as a motive power and as a control agency has been the most important factor in the extension of these benefits. But the half has not been realized. For the electrical industry there still exists the greatest opportunity further to develop applications of electricity to do the work of man, or, more effectively perhaps, to multiply the work of the individual. Industry after industry have not even dreamed of what electricity can do to solve their production and labor problems. There is practically no task that electricity can not ultimately perform. But what of the human factor? Once again — it is only the more simple of control operations that electrical equipment now supplies — the beginning has not been much more than made in what can be done to replace the present necessary human brain by selective electrical control apparatus.

Genius rises to meet the demands of the times. The electrical industry will not be slow to recognize and grasp the opportunity of service to the nation in this problem. It must tell the rest of the country of its ability and its plans. More and more will it relieve industry of its labor problems, freeing machine-bound Americans to take the place of foreign importations and to become better paid — because more efficient — men and citizens. In this way will electricity in the hands of American inventive ability continue to prove its inestimable value to humanity and to the nation.

Farley Osgood

A prominent engineer and forceful executive who has a particular faculty as an organizer and director of men.



FEW men can find the time or have the ability or inclination to contribute personally and constructively to many different activities in the electrical industry, and pre-eminence is usually obtained by those who have specialized and concentrated on one particular phase. Farley Osgood is a leader who has established himself as an active worker in many electrical activities and has carried out the letter and spirit of his belief in the benefits to be derived from co-operative work and personal participation in things which advance the interests of the industry. As vice-president and general manager of the Public Service Electric Company of New Jersey, Mr. Osgood directs the engineering and business activities of one of the largest light and power utilities, yet, through his ability in organizing a supporting staff, he finds time to take an active part in the work of the national scientific and public utility organizations.

Mr. Osgood was born in Boston in 1874 and after completing his studies at the Massachusetts Institute of Technology in 1897 he entered the service of the American Telephone & Telegraph Company. He rapidly advanced in this organization to the position of territorial manager in New Jersey. After five years he became chief engineer and general manager of the New Milford Power Company in Connecticut and was very active in working out pioneer engineering problems associated with 33,000-volt transmission. Four years later Mr. Osgood became general superintendent of distribution for the Public Service Electric Company. His ability as an organizer and educator of men brought about rapid advancement until he was directing the production and engineering departments, and in April, 1917, he became vice-president and general manager of the company.

In association work Mr. Osgood has been very active. He was vice-president of the A. I. E. E. in 1914-16 and manager in 1911-14, and he has served as chairman of the New York Section. In the N. E. L. A. he contributed largely to national specifications as chairman of the overhead-line construction committee, and he had much to do with the formulation of the National Electrical Code as a representative of the A. I. E. E. His long-extended and valuable service in association work has seldom been equaled, and the electrical industry is indebted to him in unusual degree for his work and counsel. His personal and social popularity is attested by his membership in many social and sporting clubs in New York and New Jersey.

Editorial Comment

Electrical World, March 10, 1923

Volume 81 Number 10

Phenomenal Growth in the East

ORDINARILY in matters electrical it is the West that sets the pace. We are wont to associate the West with things progressive and with engineering of the spectacular or daring sort. Are there records of huge units or exceedingly high potentials to be established, it is almost taken for granted that the West will supply them. But while we admire the enterprise and initiative so often and so freely displayed by our Western friends, we ought not to overlook records being made in the conservative East. For instance, last year the Brooklyn Edison Company added more than 55,000 new customers to its lines and made power contracts aggregating over 60,000 hp.—a huge central-station system in itself. The gross operating revenue during the year increased 18 per cent, while the gain in the net corporate income was approximately 52 per cent.

But that is only part of the story. To keep pace with such a growth requires equipment and new capital, and particularly an organization capable of responding to such large demands. These things, through the foresight of M. S. Sloan and the co-operation of the Bradys, have all been provided. The authorized capital of the company has been increased since 1921 from $19,000,000 to $50,000,000. Work has started on a new and most interesting generating station and a new office building. Lines have been extended right and left, and so great is the demand for service that it is only with difficulty that the company manages to keep from being literally swamped. This desire for electricity has swept over the whole industrial section of the East like a tidal wave. Boston, New York, Philadelphia, Newark, Baltimore, Buffalo, Pittsburgh, Cleveland, Detroit and Chicago have all felt it, so that for some little time to come things will be humming in the eastern part of the country.

Cincinnati Curtails a Needed Service

FINDING itself short of funds, Cincinnati has decided to curtail some of its public lighting—not that the streets of Cincinnati are the best lighted in the world or that the city is exceptionally free from crime but because its Director of Public Service is lacking in discernment and does not appreciate just what benefits proper street lighting bestows on a community. When electricity was first used for street lighting its fitness for the purpose was instantly recognized. Among those most outspoken in their praises were directors of public safety and police commissioners, who saw in the new light a deterrent to crime. So great was appreciation that it became quite common to say, "An arc lamp is equal to a policeman."

Considering the wide difference between the cost of the lamp and the cost of the policeman, the constant service of the one compared with the other, and the fact that street lighting is the only public service which benefits every man, woman and child in the community, the wonder is that appropriations for street lighting are not twice as large as they are. Certainly no city is overlighted; none, in fact, is even adequately lighted, and for a city of the size and importance of Cincinnati deliberately to weaken its safety and protective measures is shortsighted and blameworthy. It indicates a lack of enterprise which one would not expect in the stanch old city, whose name recalls both Revolutionary and Roman history and which was a flourishing town when Cleveland was a hamlet and Chicago still unborn.

The Manager of the Small Utility Must Fit His Community

THE executive of a public utility property in the large community has an organization of specialists at hand through which the details of engineering, accounting, legal and operating matters are handled. Such an executive is selected largely for his ability as an organizer, as a man to be respected by the business community of which he becomes a part. The small community executive, however, has an entirely different atmosphere and problem. Not only must he be his own organizer, but he must also bear the brunt and responsibility in almost every line of activity his company is called on to pursue. In addition he must fit into the community's social and commercial life and way of thinking in a manner that makes the people he must deal with feel at home with him and he with them. It is a very difficult problem indeed.

The rôle is rather a large one for one man to fill, especially when the salaries that can be paid are such that they appeal principally to young men just beginning their careers. Yet the problem must be faced in most communities that have utility service, for, after all, there are few great cities and an overwhelming number of lesser communities.

One Middle West syndicate with small-town properties has found that the point in which the managers in such places most often fail is inability to get the viewpoint of the community, talk its language and be a part of it commercially and socially. This particular syndicate is now making it a practice to employ a local man with some practical experience in operation who has, either by being brought up in the community or by long residence in it, established himself as an honorable and upright individual in whom the public has confidence and who has a record of business experience sufficient to justify the general estimate of him.

With a man of this kind at the head of a local organization, the executives of this particular company feel that any technical and operating shortcomings he may have can be supplied under the existing system of syndicate management and operation, and that he can be depended on to ask for help in the problems on which he may lack experience. Public confidence, it is held,

can rest only on the personality of the man himself, and the selection of men for executive positions in the smaller communities must rest largely on the way in which they measure up in this regard.

Give Adequate Support to the Meter and Test Department

SOME operating companies provide excellent meter and test facilities. Others overlook them or neglect them entirely. Why this should be so is hard to understand when one considers the fact that meters are the cash registers of electric service systems and are more liable to under-register than over-register. Furthermore, why isn't it more generally recognized that trouble forestalled in other apparatus means a saving in investment, operating expense, revenue and good will? Adequate testing facilities plus scheduled inspection and maintenance are the means of forestalling trouble.

It seems axiomatic to state that the meter and test department to be effective should be provided with the necessary testing apparatus and that it should have convenient space in a building which is centrally located for the work handled. The head of the meter department may have some ideas regarding the apparatus he needs and the building space and location preferred. Usually it will be found that most of his desires can be satisfied at an expense that will bring a neat return on the investment if the intangible as well as the tangible results of inadequate test facilities are considered.

Wire Covering for Overhead Lines Gives False Sense of Security

IF THE proposed requirement that approved weatherproof or rubber insulation be provided on all overhead conductors operating at potentials up to 5,000 volts is included in the new edition of the National Electrical Code (up for final public hearing Monday, March 12), it is bound to give many persons a false sense of security. In reality such insulating covering has very doubtful protecting value at voltages above 2,300 and questionable value even at this voltage after being in service a short time. Central-station operating practice has rather generally been built on the basis that the insulating value of weatherproof covering is so uncertain that, for their own safety, workmen must be instructed to proceed on the assumption that all conductors being worked upon are bare. This practice is based on a sound foundation of experience, and there is no development in view that promises a reasonably priced insulating covering which will withstand the effect of climatic conditions indefinitely and retain its insulating value. Despite this condition, the sole basis on which advocates of this proposed addition support it is the assumption that weatherproof covering has some protective value part of the time and for that reason should be used. It is this uncertain value that makes its use most hazardous. Even if it is used to prevent accidental swinging contact, there is every likelihood that the covering will become abraded by rubbing contact and not provide the protection intended.

There is another reason why weatherproof covering should not be used on all conductors up to 5,000 volts, and that is that it increases the diameter exposed to wind and sleet nearly 100 per cent and increases the hazard of wires breaking. Another factor is that the requirement of a weatherproof covering of doubtful effectiveness would increase unjustifiably the expense of rural service.

If insulating covering be advisable for all wires up to 5,000 volts, it is surprising that this requirement is so briefly covered in the National Electrical Safety Code. As a matter of fact, a provision of this character was withdrawn from the National Electrical Code in the 1920 edition. The most dependable way of removing any life or fire hazard that may exist from close proximity of wires of the class considered to other objects is to provide ample clearances and safe construction, as is done by progressive companies and prescribed by the National Electrical Safety Code.

There is no reason to believe that central stations and others will discontinue the use of weatherproof wire where they now employ it. But it is best to defer the inclusion of the proposed blanket requirement for all wires up to 5,000 volts until it can have more complete consideration.

Outdoor Construction Should Not Become a Fad

THE growth of sentiment in favor of putting apparatus out of doors instead of under a roof has been an interesting phenomenon. Ten years ago the radical who suggested putting switches or transformers out of doors to save space and expense within the four walls of a station was looked on as a fit subject for the psychopathic ward. Rather gradually, as becomes the spirit of the conservative, a change in opinion came about. The first open-air switches were installed often from sheer inability to meet architects' bills. They were followed by out-of-door transformers and by substations in their entirety. More recently there have been, as will be remembered from published descriptions, some very useful experiments in outdoor generating stations. Now the key to the whole situation is a golden one. Broadly, there is no particular reason for designing weatherproof apparatus, save that its extra cost will be less than that of constructing inclosed space in which to stow it. In very high-tension work part of this extra cost is implied in the provisions for getting circuits into and out of station structures.

The early step to mere utilization of air switches whenever practicable was a simple one, very logically followed by putting the transformers out of doors so that only low-tension circuits would have to enter or leave the station building proper. There was the collateral advantage that the exit of the transformers took with it a further amount of switchgear.

The whole matter of "going the limit" and putting the generators out of doors is really one of climatic conditions. There are cases in tropical and subtropical climates where, save for a roof to shed the sometimes heavy rains, a building in the ordinary sense seems superfluous. In our Northern climate protection for the station staff, if not for the apparatus, is essential. In hydro-electric plants the wheels, like the penstocks, have not infrequently been placed in the open and driving shafts brought within the station for the comfort of the attendants. From an operative standpoint almost any class of equipment can be made sufficiently weatherproof to permit its successful operation out of doors, but does it pay? Generally speaking, it is doubtful, as regards the mass of the generating apparatus and auxiliaries. That it pays for transformers and their accessories is due chiefly to the fact that the ac-

cessories have gradually taken up more and more room and involved more and more cost to a point where one almost can say that the tail is wagging the dog, the switchboard swamping the rest of the equipment so far as the balance sheet is concerned.

If the engineer rigorously holds down costs in the matter of mere structure, he is very likely to gain enough in convenience and cost of the general station equipment to be worth the while. If he feels it necessary to employ switching apparatus that must be installed in a bombproof structure, it does not make much difference whether that structure is under a roof or not. If the transformer leads can be properly protected by roofing in or otherwise, there is certainly gain in keeping high-tension equipment where plenty of air, one of the best and cheapest insulators, is available. The main ends to be sought are simplicity and reliability, and it is well to remember that these may be sacrificed out of doors to just as ill effect as under a roof.

Theory Now Needed in Practice

THE so-called practical engineer has done a splendid job in this country. He was the rough-and-ready type who could adapt the new discoveries in the electrical art to utilitarian purposes in order to meet the demands of a young, vast and rapidly developing nation. His scale of achievement cannot be matched elsewhere. It has placed America in the front rank as regards the number and extent of electrical installations.

During this era of strenuous pioneering the practical engineer was prone to ridicule the theoretical engineer —also so-called. The theoretical engineer of that period was typified by the foreign technician whose problems were associated with minor and small-scale developments in old and well-developed localities. The practical engineer had no scholarly leisure to delve into the unknown, no incentive to achieve perfection and no necessity for checking up carefully the economical and technical performance of his equipment. It was natural for him to label theoretical treaties "pipe dreams" and to adopt the motto "Practice makes perfect."

Today conditions have changed. No longer is there the imperative demand for engineering exploitation of virgin territory or readily available natural resources. Today's problems are connected with the economical operation, consolidation and remodeling of existing systems and with the demand for technical accuracy in the selection and operation of engineering equipment and installations. Now the theoretical engineer is called into commercial practice, and the operating and practical engineer of the old school often finds himself handicapped. In electrical engineering as in no other branch theory has reached a plane far above operating practice, and there is an imperative call for the closer coordination of theory and practice through the education of the operating personnel, which, of course, includes many high-grade practical engineers.

Few operating engineers remember much more than the rudimentary mathematics and electrical theory they learned at college, yet the efficient performance of their work necessitates the use of hyperbolic functions in transmission, Kirchoff's laws in distribution, the dielectric circuit in cable practice and fundamental theory in dealing with transients and protective equipment. Exponential functions and calculus are necessary tools for the solving of practical problems. Indeed, calculus is considered elementary mathematics today by the theoretical specialists, if their literary productions be accepted as criteria.

In order for the operating engineer to select, operate and install economical and properly rated lines and cables, breakers and switches, motors, arresters, relays and meters, he must either increase his theoretical proficiency or be at the mercy of a small group of theoretical engineers in the ranks of electrical manufacturers and consulting engineering firms. "Cut and try" and guesswork are alike out of date in the economical operations of today, and the practice of copying other installations is no longer to be commended in highly refined, extensive and complicated engineering activities.

To wed electrical theory and electrical practice is a real job, and much work must be done before it is accomplished. Professional engineering societies serve, among other things, as clearing houses for the production of certain specialized theoretical papers which can be understood by a very limited number of specialists and by still fewer operating engineers. These papers must be interpreted, and the specialists must be drafted into the educational scheme to educate all engineers in the theory of their art. The schools can do good work by furnishing extension courses, textbook material, lecture courses and other helpful facilities. The technical press is an active agency in interpreting and in carrying out the educational program. The whole industry should change its attitude toward the value of theoretical training and take active steps to bring theory and practice nearer together.

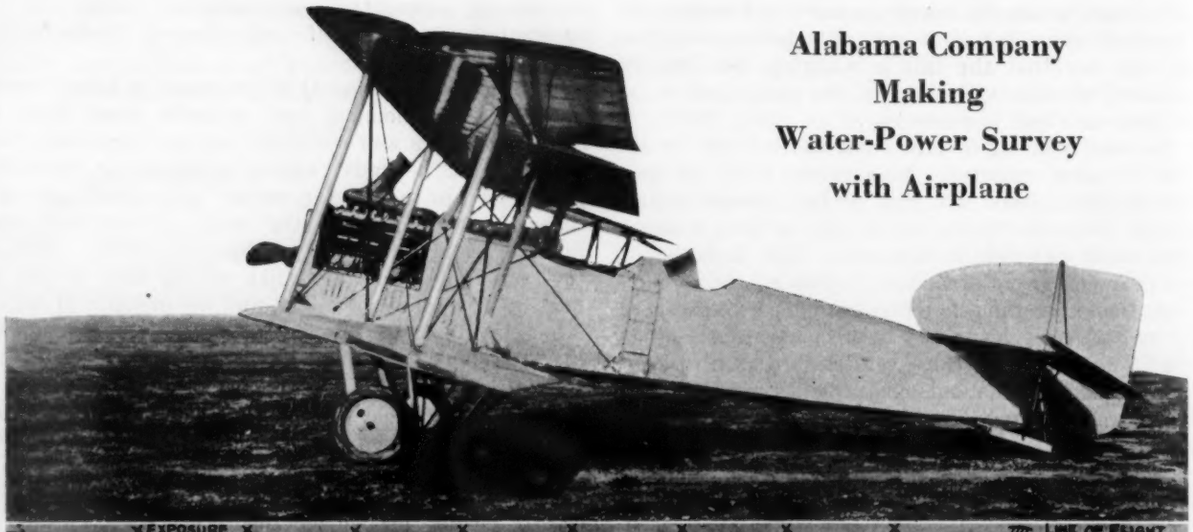
Too Great Haste Makes Waste

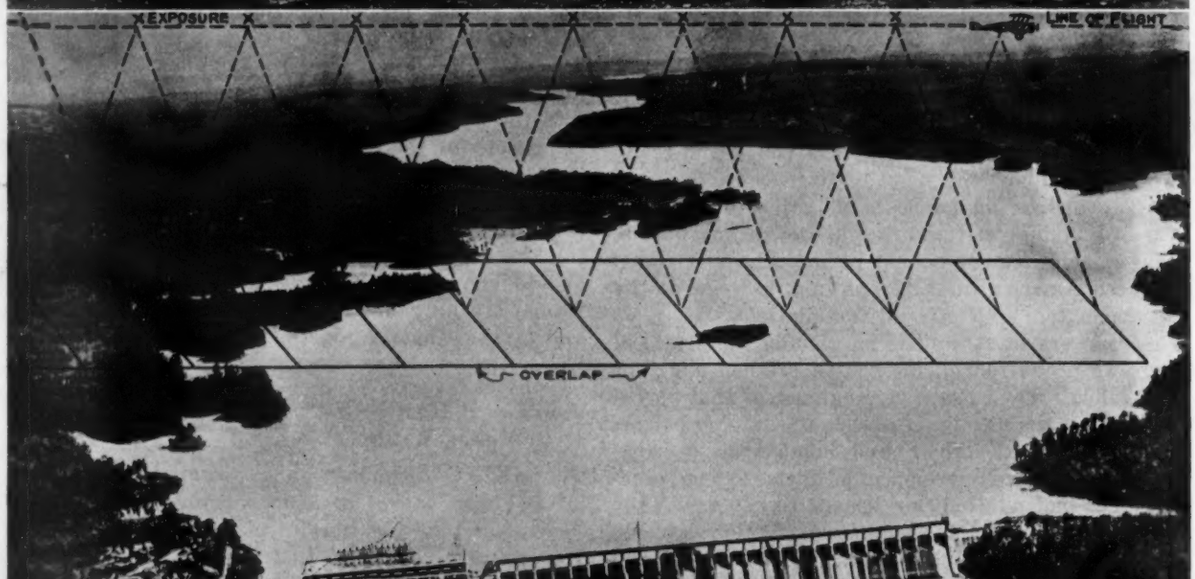
MAKING estimates on a "wanted day before yesterday basis" because some executive feels that he cannot take the time to make a thorough investigation, or does not know that it takes time, is the nightmare that many an engineer experiences daily. Generally the individual who is responsible for unreasonable demands is a man with a financial viewpoint only, or of the type known as a "go-getter."

It is refreshing to hear a banker take this sort of thing to task as did H. D. Thrall, vice-president of the Minnesota Loan & Trust Company, recently in an address before the Engineers' Club in Minneapolis. Mr. Thrall seriously questions whether we are not sacrificing more to speed than is really necessary. He points to the habit engendered during the war of doing things regardless of cost and without proper attention to preliminary detail, because human life and the fate of military movements depended on getting such things done, as one to be broken and a return to sane planning and building encouraged.

Incompetent engineers have produced many a bad plant such as Mr. Thrall mentions in his talk, but many more mistakes have been made because some one in authority forgot that raising the money to carry out a project still leaves the physical project as far from completion as ever. Accuracy and vision can be expected in engineering work only when the engineer, in addition to being competent, has time accorded him to make a thorough investigation. "Wanted day before yesterday" and "I want what I want when I want it" are executive attitudes that cause far more serious errors than engineering incompetency.

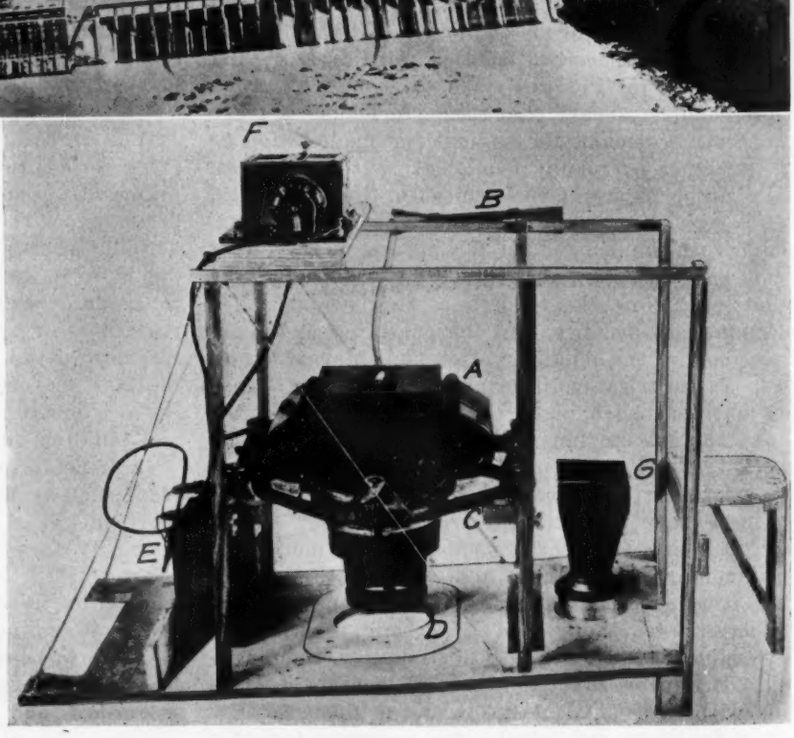
Alabama Company Making Water-Power Survey with Airplane





BY CONDUCTING an airplane photographic survey instead of the ordinary land survey, the Alabama Power Company expects to make a thorough study of the relative merits of water-power development on the Tallapoosa River in about sixty to seventy-five actual hours of flying, and besides save about 50 per cent of ordinary cost of surveying. The company estimates that it would take a land survey force at least eighteen months to do the same work if that force were no larger than the one which is to be employed for the air survey.

The plane which will be used is of the Breguet bombing type capable of carrying five passengers, a pilot and 600 lb. of equipment at a maximum speed of 135 miles per hour. An Eastman "K1" camera with a single-focus lens of 10 in. will be mounted over an aperture in the cockpit of the airplane and will contain a roll of film 75 ft. long, sufficient for 100 exposures.



Some Economic Phases of Engineering—II

Methods of Procedure When Cost, Efficiency, Load or Other Curves Must Be Analyzed for Economic Study of Engineering Design—Specific Handling of Turbine Water-Rate Curves Used for Illustration

By GEORGE F. MARSTELLER
Electrical Engineering Department, Utica Gas & Electric Company

SOME economic phases of the engineering study necessary prior to the replacement of a turbo-generator were discussed in a previous issue, a general method being described. Since special analysis is sometimes required, it seems advisable to look further into this particular type of problem. In the previous illustration a practically constant load was tacitly assumed; that is to say, for $8{,}760T_L$ hours per year, there was a constant load of 7,500 kw., differing from this value, more or less, for a total time which is such a small percentage of T_L that these deviations from 7,500 kw. can be neglected. Though such a condition is true of much power-consuming apparatus or equipment, it rarely represents the state of affairs of a power-producing device, as a turbo-generator, for example.

For studying the relative economic advantages of increased efficiencies in the particular case of a turbo-generator, reliable or guaranteed water-rate curves must be insisted upon. At the present stage of development the writer is not aware of any manufacturer that either can or will guarantee the steam consumption of a turbine per kilowatt-hour to a degree of accuracy including the second decimal point, under all conditions of vacuum, pressure and superheat. Owing to unavoidable factors such as deposits or wear on bladings, changes in clearances, etc., a water-rate curve is not absolutely constant in shape or position. However, by obtaining reliable curves for the most favorable and most unfavorable working conditions as to pressure, vacuum, superheat, etc., a trustworthy comparison could still be carried out.

Since we are dealing here with relative rather than absolute thermodynamic efficiencies, the factors which cause instability from external and internal sources are inherent in all types, and unless the design represents a radical departure in principle or construction, these inherent factors most probably affect to the same relative degree the machines being compared and therefore annul each other for the purpose of economic comparison. Where this is known not to be the case, allowance for additional contingencies must be made. Fig. 1 represents the guaranteed water-rate curve obtained by test of a modern compound turbo-generator of 60 000 kw. capacity, taken at 28½ in. vacuum referred to a 30-in. barometer.*

Speculating upon these conditions as being fixed, it is evident from the curve that a gain of only 1 per cent in efficiency at a full load of 50,000 kw., with an annual running time of say 5,000 hours and an evaporation of 8 lb. of water per pound of coal, the latter costing $3 per ton, would result in a yearly saving of:

$$Sa = 50{,}000 \times (10.93/8) \times 3 \times R_M = \$5{,}117,$$

where 10.93 is taken from water-rate curve. (Here $R_M = 0.02497$ corresponds to $T_2 = 5{,}000/8{,}760 = 57$ per cent, $E = 1$ per cent. (See Fig. 1, ELECTRICAL WORLD, January 27, page 217). That is, under the conditions assumed, a reduction in pounds of steam per kilowatt-hour from 10.930 to 10.8207 would net a yearly saving in coal of $5,117, which is an appreciable sum.

However, with a constantly fluctuating load the water-rate curves to be compared may have such a shape that a gain in efficiency at one load might result in no advantage, a very insignificant gain, or even a loss in efficiency, at other loads. Since in the most general case the loads and thus the relative efficiencies will vary at all times, it becomes necessary to examine the sum-total effect throughout the entire range of all points of the load range.

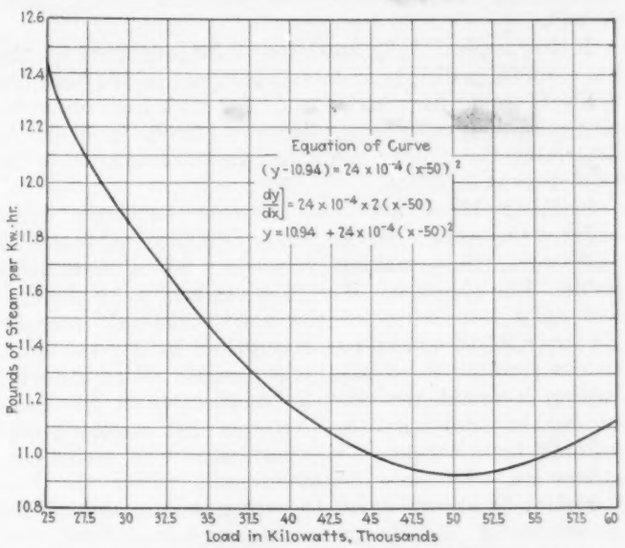


FIG. 1—WATER-RATE CURVE OF MODERN 60,000-KW. CROSS-COMPOUND TURBO-GENERATOR TAKEN AT 28½-IN. VACUUM REFERRED TO A 30-IN. BAROMETER

The curve in Fig. 1 is remarkable for its general characteristics, not only from the point of view of operating performance, but, as examination will show, because it follows very closely a parabolic law of the form $(y - a) = k(x - b)^2$, such that in this case $y = 10.930 + 24 \times 10^{-4} (x - 50)^2$, and therefore the rate of change of pounds of steam per kilowatt-hour, or the stability of steam consumption for the various loads, would be expressed by the differential of the parabolic equations above, which gives a straight line such that the rate of change along the parabola—i.e., the slope of this straight line for any value of x—is equal to:

$$dy/dx = 48 \times 10^{-4}(x - 50).$$

Unfortunately, most water-rate curves cannot accurately be expressed by the simple parabolic equation

*Courtesy *Electric Journal*, May, 1921.

above, though in many cases an approximate equation can be had by assuming it to have a general parabolic form with displaced vertex.

Also, for some curves the potential series $P = P_0 + AL + BL^2 + CL^3 + DL^4 + \ldots$ gives satisfactory results, where A, B, C, D, etc., are coefficients found by solving the simultaneous equations formed from letting the approximate curve to be determined run through several corresponding points P and L on the actual curve already given by test. Usually an equation of the fourth degree is sufficient for all practical purposes.

In most instances, however, the mathematical advantage of dealing with such curves as exact equations is outweighed by the very laborious processes of obtaining them. This is especially true when simpler, even if somewhat less approximate, methods can be suggested, and the merits of each case to be dealt with become then a matter of judgment and experience.

METHOD OF COMPARISON

In the attempt to look into these salient features more explicitly, let Fig. 2 represent some typical daily load curve as applying to N days per year, the remaining days being idle; that is, the time-load factor $T_L = N/365$.

If the typical daily load curve for one part of the year differs radically from another part of the year, an analysis would have to be made for each case individually and their effects studied collectively in order to determine the proper contribution of each toward the total economic effect.

Striking blind averages between extremes often reduces the most laborious study to a piece of scientific guesswork, thus making it useless as a dependable guide. For simplicity, Fig. 2 is assumed to be the typical daily load curve of the only turbo-unit present. However, if the main bus is supplied by several alternators running in parallel, and possibly all of different rating, it would even then in most cases be necessary to obtain individual load curves by metering the kilowatt-hour output of the particular unit under consideration. In some isolated cases, where the load variation is known never to exceed definite limits, the governors of all but one machine are held fixed, thus compelling the fluctuations in load to be taken up by this single unit. Where this is not the case, we are justified in considering the division of the total power-component load as proportional to the several units only, provided that the necessary operating conditions as to governor adjustment, etc., are maintained.

Examination of the load curve of Fig. 2 gives a total area below the curve which corresponds to a daily output of 53,570 kw.-hr., and the mean daily load is therefore 53,570 ÷ 24 = 2,232.7, thus resulting in a "daily load factor" of 2,232.7 ÷ 3,360 = 66.3 per cent. Suppose that there was a temporary peak load of 740 kw. superimposed upon the present 3,360 kw. and lasting twelve minutes. It would not affect the average load much, since it would contribute at the most probably only an additional 150 kw.-hr., increasing the mean load from 2,232.17 to 2,238.5 and giving a new "load factor" of 2,238.5 ÷ 4,100 = 54.5 per cent. To evade this conventional but vague, and for many purposes utterly useless, definition of load factor, and in order to gain a more comprehensive insight into the distribution of all loads with respect to the total time we may resort to a replot of Fig. 2 and proceed as follows:

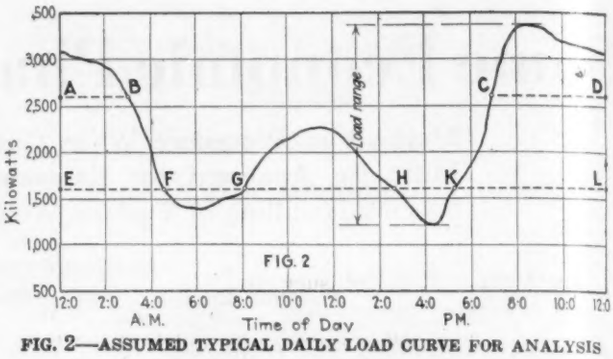


FIG. 2—ASSUMED TYPICAL DAILY LOAD CURVE FOR ANALYSIS

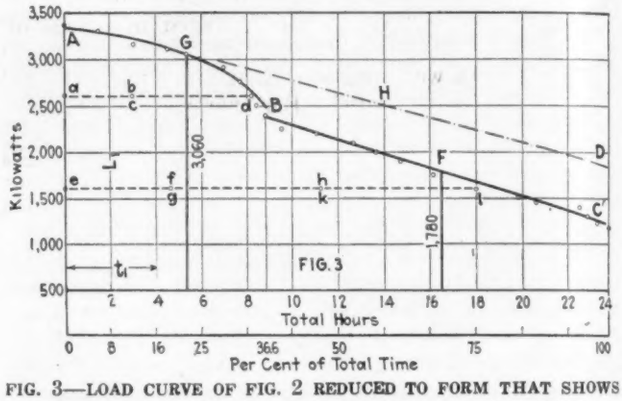


FIG. 3—LOAD CURVE OF FIG. 2 REDUCED TO FORM THAT SHOWS THE SHARE EACH LOAD CONTRIBUTES TO THE TOTAL KILOWATT-HOURS GENERATED FOR THE DAY

Consider the lines *a-d* at 2,600 kw. and *e-l* at 1,600 kw. The former intersects the load from *a-b* and *c-d*; the latter from *e-f*, *g-h*, *k-l*. If we now add the length *a-b* to *c-d*, we obtain a new line *a-b-c-d* in Fig. 3, laid off at the identical load of 2,600 kw. and terminating in *d*, which is one point on the new curve. In like manner *e-f*, *g-h* and *k-l* are laid off at their respective load of 1,600 kw., and a new line *e-l*—being the sum of the three lengths just mentioned, terminating in *l*, is obtained. Connecting the required number of all such points as *d* and *l*, taken for the entire load range of the curve to be replotted, we obtain a new and irregular curve. The area of this latter curve, if an infinite number of points were taken, would represent exactly the same number of kilowatt-hours as the original.

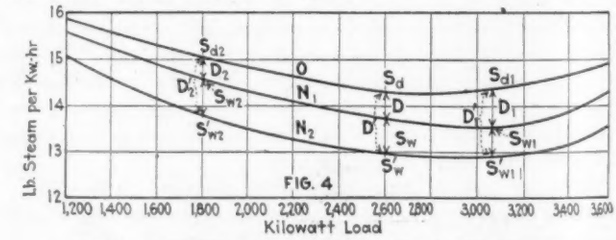


FIG. 4—ARBITRARILY ASSUMED WATER-RATE CURVES TO ILLUSTRATE METHOD OF COMPARISON

Starting with the greatest peak, we draw a series of lines parallel to the abscissa. The spacing of these lines depends upon whether or not critical points or abrupt changes are encountered or whether they pass through sections of the curve where the variations are slow and the slopes more gradual. Out of some twenty lines used in this manner only two are shown in Fig. 2. However, an exceedingly close approximation is obtained by selecting a number of well-chosen points and connecting these by one or two smooth lines, as shown in Fig. 3.

This new curve does not reflect the variation of load with respect to the clock or time of day, as usual. It rather represents the share which each load is contributing toward the total number of kilowatt-hours generated. Taking the time-intervals for the period of a length on the abscissa, which corresponds to a total of one hour (collectively) during the day, then the average kilowatts during that interval will be the num-

ber of kilowatt-hours contributed by that load. For example (see Fig. 3), a load of 3,348 kw. contributes 3,348 kw.-hr.—a load of 2,095 kw. contributes 2,095 kw.-hr., etc.—each one for a period of time whose total is one hour, taken collectively, during the period of one day, or twenty-four hours. The smaller the interval we choose, the more nearly does the average kilowatts for that interval approach the *actual* load and hence the actual kilowatt-hours contributed by that load.

Incidentally, a replot such as that shown in Fig. 3 is often a convenient means of expressing very irregular curves or graphs by a single equation, permitting their treatment algebraically. However, when even this replot cannot be very closely averaged by means of a single smooth line or curve, two separate equations will serve just as well, provided that the applicable limits of each are kept in mind. For example, Fig. 3 happens to be such a case. The curve from A to B proves to follow very closely a parabolic law with displaced vertex, thus: $(a - x) = k(y - b)^2$, where $a = 36$ (per cent), $b = 2{,}300$. From this $k = 11/36 \times 10^4$, and hence:

$$y = \frac{600}{\sqrt{11}} \sqrt{(36 - x)} + 2{,}300.$$

Similarly the straight line $B - C'$ is expressible by $y = a - R \times \tan^{-1}\theta x = 3.075 - 18.84x$, where $a =$ intercept with the y axis, $R =$ scale ratio between y and x axes, and $\tan^{-1}\theta =$ slope of line $B - C'$.

To get the average ordinate for the curve $A - B$, its equation may be integrated by the use of the calculus, or since in this case it happens to be a parabola, more directly from the simple fact that the area within a parabolic arc is two-thirds times the area of the circumscribed rectangle. Therefore, we have at once (see Fig. 3): Average ordinate $= 2/3 \times 8.8(3{,}340 - 2{,}500) \div 8.8 = 560$, thus making the total average ordinate $(2{,}500 + 560) = 3{,}060$, as shown. The midway, or average, ordinate for the straight line being evidently 1,780, we have thereby divided our entire daily load curve into two characteristic parts which are representative of actual conditions. One part contributing: 3,060 kw. $\times$ 8.8 hours $=$ 27,104 kw.-hr.; the other part furnishing: 1,780 kw. $\times$ 15.2 hours $=$ 27,056 kw.-hr., giving a total of 54,160 kw.-hr., which compares very favorably with the actual kilowatt-hour output of 53,570. It contains an error of only about 1 per cent.

To avoid the possibility of misunderstanding to the casual reader it may be said that the fact that these two mean loads, taken over unequal intervals of time, contribute almost identical kilowatt-hours, is a mere coincidence.

Formulas for General Purposes

Before proceeding to apply the two mean loads of 3,060 kw. and 1,780 kw. above to the water-rate curves of Fig. 4 we may summarize the algebraic relations more generally in order to make them applicable to all cases—not only water-rate curves. Fig. 4 shows a number of purely arbitrary water-rate curves, merely used to illustrate the methods under discussion. Let curve O be the water-rate curve of the old machine and N_1, N_2 be those of the new machines to be compared. The more unevenly and irregularly these curves are and run with each other within the load range, evidently the more time intervals must be taken on the replot (Fig. 3) in order to apply more closely the particular differences between the curves of Fig. 4 to that corresponding load. We must keep in mind that the abscissa of Fig. 4 corresponds to the ordinate of Fig. 3, and that obviously the particular differences between the water-rate curves, a few of which are indicated by D_1, D_2, D'_1, D'_2, etc., are a measure of the gain in comparative efficiencies.

Let:

N = number of days of twenty-four (or m) hours each during which the machine is running.

P = number of pounds of steam per pound of coal.

$L_1, L_2, L_3 \ldots L_n$ = mean loads during the time intervals $t_1, t_2, t_3 \ldots t_n$

$t_1 + t_2 + t_3 + \ldots + t_n = 24$ (or m) hours (from Fig. 3).

$S_{d_1}, S_{d_2}, S_{d_3} \ldots S_{dn}$ = old steam consumption in pounds per kilowatt-hour at such mean loads as $L_1, L_2, L_3 \ldots L_n$.

$S_{w_1}, S_{w_2}, S_{w_3} \ldots S_{wn}$ = new steam consumption in pounds per kilowatt-hour for one prospective machine at such mean loads as $L_1, L_2, L_3, \ldots L_n$.

$D_1 = (S_{d_1} - S_{w_1})$, $D_2 = (S_{d_2} - S_{w_2})$, etc.

$\frac{C}{2{,}000} = C' =$ cost per pound of coal.

O_d, O_w = yearly operating cost in coal of old and new machine to be compared.

I_n = total yearly interest charges.

M_d, M_w = investment on old and new machine respectively.

V = greatest permissible investment in new machine over old one.

Therefore, for the old machine we have:

$$O_d = \frac{NC'}{P} \times (t_1L_1S_{d_1} + t_2L_2S_{d_2} + \ldots + t_nL_nS_{dn}) \quad (1)$$

Similarly:

$$O_w = \frac{NC'}{P} (t_1L_1S_{w_1} + t_2L_2S_{w_2} + \ldots + t_nL_nS_{wn}) \quad (2)$$

Thence:

$$O_d - O_w = \frac{NC'}{P} [t_1L_1(S_{d_1} - S_{w_1}) + t_2L_2(S_{d_2} - S_{w_2}) + \ldots + t_nL_n(S_{dn} - S_{wn})] \quad (3)$$

$$= \frac{NC'}{P} [t_1L_1D_1 + t_2L_2D_2 + \ldots + t_nL_nD_n]. \quad (4)$$

In some special cases it is more advantageous to express t_1, t_2, t_3, etc., in per cent, if the gain in efficiency is also expressed in per cent, so that $E = 1 - (S_d/S_w) = (1 - k')$, and $R'_M = T_2E$, which can be read off a suitable diagram such as Fig. 1, ELECTRICAL WORLD, January 27, page 217. Then equation (4) becomes:

$$O_d - O_w = \frac{mNC'}{P} [L_1S_{d_1}R'_{M_1} + L_2S_{d_2}R'_{M_2} + \ldots + L_nS_{dn}R'_{Mn}] \quad (5)$$

By making $t_1 = t_2 = t_3 = \ldots = t_n$, where $t_1 + t_2 + t_3 + \ldots t_n = m$ hours, and n is the total number of equal time intervals on the replot of the load curve (as Fig. 3), then $t_1 = t_2 = t_3 = \ldots = t_n = m/n$, (6)

and equation (4) can be written:

$$O_d - O_w = \frac{NC'm}{Pn} \times (L_1D_1 + L_2D_2 + L_3D_3 + \ldots L_nD_n), \quad (7)$$

and if, for example the value of P (the pounds steam per pound of coal) is also a known variable for certain conditions, as obtained from a boiler load curve, then equation (7) becomes:

$$O_d - O_w = \frac{mNC'}{n} \times \left(\frac{L_1 D_1}{P_1} + \frac{L_2 D_2}{P_2} + \frac{L_3 D_3}{P_3} + \ldots + \frac{L_n D_n}{P_n} \right) \quad (8)$$

If in any unusual case the comparative curves (in Fig. 4) should overlap, then the respective term or terms, including this interval of overlap in any of the equations above, would be preceded by a sign opposite from that which precedes them here.

NUMERICAL EVALUATIONS

In order to make this method more readily usable a few numerical solutions will be evaluated from the expressions developed above. Assume $P = 8$, $C' = 3.2/2{,}000$ and $N = 300$; then, using equation (3), the two mean-load values over the two unequal time intervals as previously derived from Fig. 3, and by aid of Fig. 4, we have:

$$O_d - O_w = \frac{300 \times 3.2}{8 \times 2{,}000} [8.8 \times 3{,}060(14.40 - 13.55) + 15.2 \times 1{,}780(15.05 - 14.60)]$$

$$= \frac{9.6}{160} (22{,}888.8 + 12{,}175.2) = \$2{,}103.84.$$

If we now take six equal time intervals, we are justified in assuming by inspection that each interval in both Figs. 3 and 4 is small enough to insure that each part of the curves covered by each interval will in no way seriously depart from a straight line. Therefore, the midway ordinate of each interval very closely approaches the actual average for that interval, and by using this method in connection with the replot we can obviate the necessity to determine either the areas or the equations of any curve. From equation (6), $m/n = 24/6 = 4$ (number of hours covered by each interval). The values for L and D are read from Figs. 3 and 4, and the various results as required from equation (7) may be conveniently arranged as shown in the accompanying table.

METHOD OF TABULATING CALCULATIONS AND DIFFERENCE IN RESULTS DUE TO SELECTION OF EQUAL TIME INTERVALS

m/n-Hour Intervals	I	II	III	IV	V	VI
Corresponding: L	3,265	2,985	2,300	1,980	1,680	1,375
Corresponding: S_d	14.50	14.33	14.52	14.84	15.20	15.60
Corresponding: S_w	13.67	13.53	13.98	14.32	14.74	15.27
$S_d - S_w = D$	0.83	0.80	0.54	0.52	0.46	0.33
LD	2,710.0	2,388	1,242	1,029.6	772.8	453.75

Then $\sum L = 13{,}585$,

also $\sum LD = 8{,}596.1$;

hence, $m/n \times \sum L = 54{,}340$ kw.-hr., which compares well with 53,570 kw.-hr. from original load-curve, and $\frac{mNC'}{nP} \times \sum LD = \frac{24 \times 300 \times 3.2}{6 \times 8 \times 2{,}000} \times 8{,}596.1 = \$2{,}063.06$, showing a difference as compared with the previous solution of:

$$(2{,}103.84 - 2{,}063.06) = \$40.78.$$

Therefore:

$$V = M_d - M_w = 2{,}063.06/I_n, \text{ etc.}$$

(See ELECTRICAL WORLD, Jan. 27, 1923, page 217.)

If we had used twelve equal time intervals with their corresponding twelve-mean L and D, our result would have been 2,072.52 instead of 2,063.06—an error of less than one-half of 1 per cent, thus showing no corresponding gain in taking too many time intervals.

If the load on a machine, equipment or system, as reflected by its typical daily (or yearly) load curve, is known to increase gradually during a predicted or predetermined period of years (i.e., if, for example, the load curve assumes a shape and location as represented by *A-G-H-D* in Fig. 3), another condition arises which must be taken into account. Evidently it would be unfair to base our calculations on the initial or on the final state of affairs. The basis must be somewhere between and such that the exact location is determined by the weight average of characteristic portions of the present and probable load curve.

Assume, then, for illustration that one typical portion of the loads (higher values, lower or both) have

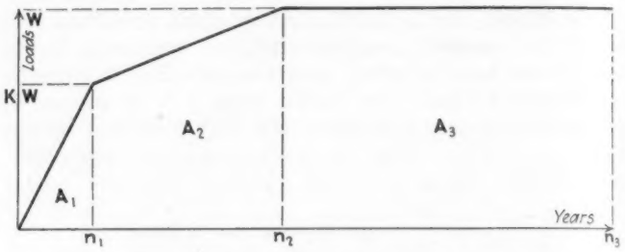


FIG. 5—METHOD OF CONSIDERING RATE OF LOAD GROWTH. THIS METHOD AVOIDS TREATING ONLY THE INITIAL AND FINAL LOAD CONDITIONS

a probable rate of growth determined by the diagram of Fig. 5.

Here, W = maximum rating of the machine; KW = fractional part of W; n_1, n_2, n_3 = corresponding of years; A_1, A_2, A_3 = corresponding areas of n_1, n_2, n_3 where n_3 is the end of useful life, owing to obsolescence, inadequacy, etc.

$$A_1 = KWn_1/2; \; A_2 = KW(n_2 - n_1) + W/2(1 - K)(n_2 - n_1); \; A_3 = W(n_3 - n_2)$$

therefore the total area $A_T = A_1 + A_2 + A_3$ divided by the total number of years or n_3 gives the average load W_g upon which to base our calculations, and this reduces to:

$$W_g = A_T/n_3 = W + W/2n_3[(K - 1)n_2 - n_1]$$

From what has been indicated previously, a similar comparison could be carried out between the curves O and N_2 or N_2 and N_1 of Fig. 4. In general, any number of curves of any shape can be examined simultaneously—curves, for instance, representing cost of coal with the number of years, fluctuations in wages, water rates, boiler efficiencies, load-variations, etc.

Two Types of Magnetic Testing

THE routine magnetic testing of the Bureau of Standards has been placed on a new basis which provides for two classes of tests. Class A will be restricted to specimens which are sufficiently uniform in dimensions and magnetic properties along their length to justify the employment of test methods of the highest accuracy, intended for use as standards for the calibration of testing apparatus and for other uses where high precision is necessary. Class B tests will be made in general in cases where the material is not sufficiently uniform to justify the use of precision methods or where the highest accuracy is not necessary. Circular 85 describes the tests in more detail and contains a schedule of prices.

Effect of Coal Supply on Public Utilities*

Essential Character of the Business Necessitates Constant and Adequate Supply of Suitable Coal, as Well as Ample Storage, to Insure Against Interruptions of Service—How Public Utilities Conserve the Nation's Coal Resources

By JOHN W. LIEB

Vice-president New York Edison Company and Chairman of Joint Fuel Committee of Three National Utilities Associations

THE development of the public utilities to their present size and importance where they serve practically the entire population of the United States has occurred largely in the last forty or fifty years. At present nearly one-third of our industries are supplied with power by central electric power stations. The total number of consumers for lighting and power exceeded ten million in 1922. Gas was supplied in 1921 to more than nine million consumers. The street railways in 1922 carried more than fifteen billion passengers. Here are a few significant public utility statistics: The total capital invested in 1922 (including gas companies) exceeded $15,000,000,000; the total kilowatt capacity of dynamos in central electric stations and electric railway stations exceeded 15,000,000 kw.; the outputs of these stations was 46,000,000,000 kw.-hr., and the number of employees was estimated at 525,000.

The magnitude of the public utilities may be realized by comparing their $15,000,000,000 of capitalization with the valuation of all of the class 1 railroads of the United States, estimated at approximately $20,000,000,000.

The essential importance of the utilities to the public welfare is also indicated by the importance and variety of useful service they render. Electric and gas lights are essential to the policing of our great cities. Fire protection, water supply, telegraph and telephone service and vertical transportation are all largely dependent for their operation on central-station service.

Domestic lighting, heating, cooking and many other household functions are dependent in our cities upon the utilities, as in like manner are urban and interurban transportation, shops, factories of all kinds, the manufacture of artificial ice, and so forth. The industrial uses to which electricity is now put are legion.

The utilities through their economical operation and low cost of energy are making possible the supply of greater and greater amounts of power for industrial workers, and, paralleling this increase, workmen are able to produce a greater value per worker through increased output.

A comparison, through a reasonably stable period, of the average horsepower available per workman and his increased productiveness shows that in 1899 the horsepower per worker was 2.12 as against 3.10 in 1914, while in the former year the annual value added to products per wage worker was $1,025, as against $1,404 in the latter. Though the output per workman is undoubtedly influenced by many factors, this increase in the application of mechanical power as a substitute for manual labor is undoubtedly a cause of the rapidly increasing wealth of the country and the emancipation of workers from drudgery and heavy labor. Largely through supply of adequate power deftly applied by American genius will this country in the coming years be able to hold her leading place in the markets of the world and still maintain for its workers the high plane of American living conditions.

The United States has outstripped the world in the total consumption of electrical energy, using about half of all the power produced and far exceeding her principal competitors. The kilowatts consumed per capita in the United States amount to 472, as compared with 163 in the United Kingdom and Ireland, 147 in France, 141 in Germany and 85 in Italy. Three small countries, Switzerland, Canada and Norway, which have large available water powers exceed the United States in the per capita consumption of electrical energy and have in that regard a material economic advantage.

UTILITIES MUST HAVE CONSTANT FUEL SUPPLY

The services of the utilities have become so essential to our industrial and civic life that should the electric and gas plants of a great city fail to function an inconceivable catastrophe would result. The public requires that the utilities maintain the continuity of service as a necessity to its health, safety and comfort, and it demands that the utilities keep in constant readiness the equipment and facilities to carry whatever load may be forced upon them, no matter how high or unexpected the demand or how adverse the circumstances. In order to do this it is evident that there must be available at all times adequate quantities of suitable fuel. During the past few years adequate supplies of coal of this character have not at all times been available. The public utility must function, and coal is the raw material upon which its service usually depends. For the public good it should, therefore, be placed beyond any danger of failure to obtain adequate quantities of proper fuel.

THE COAL INDUSTRY

During the past few years the gas and electric utilities have had great difficulty in obtaining coal of the proper quality and in the amounts needed. The supply was unreliable, the principal causes being strikes, car shortages and failures of transportation, due to congestion of equipment, resulting embargoes, etc. Yet the production of bituminous coal has not varied greatly during the last ten or twelve years. In 1910 the mines produced 416,000,000 net tons; in 1918 580,000,000 net

*Abstract of an address delivered before New York Electrical League, Feb. 28, 1923.

tons and in 1920 569,000,000 net tons. The increase from 1910 to 1920 was therefore 37 per cent.

The estimated percentage of distribution of bituminous coal mined is as follows: Industrial uses, 31.6; railroads, 27.7; electric power utilities, 5.7; domestic, export, coke and gas making, bunkering, etc., 35. The electric utilities used in 1922 34,000,000 tons of anthracite and bituminous coal.

Isolated power plants consume about two-thirds of the 31.6 per cent consumed for all industrial uses, or about 20 per cent of the total coal mined. A comparison of this consumption with that of the utilities, amounting to only 5.7 per cent of the total, indicates the high fuel economy of the utilities when the relative outputs of electrical energy are compared. These data were collected in an exhaustive study covering a number of states and the results demonstrated that the electrical utilities generated annually more energy than the aggregate produced by isolated industrial plants.

Up to the time of the war the coal business was reasonably constant, and it was not involved in serious straits until the end of 1917. In 1918 our activities in the war caused an excessive demand for coal and made a high peak which could not be fully cared for by our railroads. In 1919 conditions were fair until the advent of the miners' strike on Nov. 1, when production decreased to a low figure for about six weeks. Early in 1920 a heavy demand followed the coal strike, while on April 1, before conditions had become stable, the railroad switchmen's strike occurred. In 1921 the demand was not heavy and supply was reasonably uniform.

In 1922 coal was plentiful in quantity and reasonable in price, considering freight rates, until the great strike occurred on April 1, to be followed by the widespread strike of railway men somewhat later. Though the situation in 1922 was more serious and dangerous than that of 1919-20, it was better handled and the utilities suffered less, though the conditions last year and during the previous coal stringencies were still such as to call for the most earnest consideration.

As is well known, these great disturbances in the coal industry have caused prices to fluctuate enormously. We have not yet recovered from the results of the last disturbance and are still paying abnormally high prices, as has been the case since early in the summer of 1922.

THE CAR SUPPLY

The opening up of an excessive number of new mines had its reflection on the railroad situation, making it necessary for the railroads to divide their available cars among 2,900 more mines in 1918 and 6,800 more mines in 1920 than would have been necessary had the average production per mine in these years been maintained on the 1910 basis.

Gathering the increased tonnage from a largely increased number of mines calls for vastly increased motive power, coal-car supply and man power from the railroad to serve them all. The number of cars called for, based on the rated ability of the mines to produce coal, kept pace with the increased number of mines until for the year 1920 cars were ordered in sufficient number to load more than 830,000,000 tons—56 per cent more than the total consumption of the country. In the latter part of 1922 cars were called for at the rate of twice the annual consumption of the country.

Under the conditions described, which have existed since 1917, the utilities, as has been said, have experienced great difficulties in obtaining the required amounts of coal of the right character at prices which they could afford to pay under the prevailing rate schedules, framed when coal and labor costs were much lower.

UTILITY FUEL DIFFICULTIES

The utilities are in a sense agents of the public and must not only provide continuous service, but they hold a distinct responsibility to maintain that service at most economical rates. They are, however, peculiarly vulnerable to the injuries which result from coal crises —first, because they are strictly controlled by the regulatory authorities as to the rates they may receive for their products, and, second, because coal constitutes the absolutely essential and most costly raw material necessary in their processes of manufacture.

Quite uniformly over the United States, public utilities are regulated by public service commissions set up by the several states. They are, therefore, except in a few instances, unable readily to adjust their charges to the cost of coal and thus are at a disadvantage when competing for coal with industrial consumers.

From 20 to 30 per cent of the revenue received for products or service of the utilities is spent for fuel. By the practice of strict economy in every direction the public utilities, both gas and electric, were able to weather the period of excessively high costs during the war. Immediately following the war, however, a number of utilities found it necessary to appeal to the public, through the public service commissions, for increases in rates. In some cases these increases were allowed as applicable to the schedules themselves; in many others the exigency was met by the introduction of a so-called coal adjustment clause or coal charge.

Under the so-called coal clause plan the companies were permitted to add to their base rates, which had been established under low costs of coal, a supplementary charge based on the actual demonstrated increase of cost of coal alone, the companies themselves absorbing the similar large increases in labor, supplies and other items of expense.

These coal clauses became effective generally through the companies filing with the state public service commissions each month a statement as to their actual increases in coal costs, and on the basis of these increases approval was given for the application of the surcharge during the succeeding month. In this way a sliding scale was introduced under which the movement of the coal prices upward and downward became immediately applicable as an element in the rates.

The situation became so serious during or after the strike periods following the war, owing to shortage of production, railroad congestion, etc., that the three national public utility associations were compelled to designate special committees to aid in obtaining coal and to assist in untangling transportation difficulties. During the early summer and fall the joint fuel committee representing these associations found it necessary to intervene to aid more than two hundred utilities in order to save them from curtailment of service. This service has consisted in advising with and appealing to the government where conditions or policies required change, aiding specific utilities in

danger of shutdown through inability to purchase coal, helping to restrain prices and to guard contracts, preventing confiscation, tracing utterly lost coal shipments, and so forth. To do this it was found necessary to have an office in Washington and to maintain continuous contact with the principal administrative arms of the government, with coal dealers and their associations, with the railroads and their associations and with various other agencies which could be of service.

The experience of the utilities has proved beyond question that coal contracts are, as a rule, of little value in obtaining coal during times of extreme emergency unless protected by priority orders issued and policed under government authority.

One of the serious difficulties has been due to the fact that when there is a shortage of coal or of coal cars the supply the utilities receive on their annual contracts is often prorated proportionately with other consumers, some of whom may be "spot" purchasers.

During the periods of stress coal is usually difficult to obtain. Heat value, ash content, volatile constituent and delivery clauses in contracts are not accepted by operators—they can ordinarily sell their coal at these times without any such clauses—and changes in the attitude of mine workers and railroad conditions have often made it impossible for them to accept reasonable specifications. The result of all this has been that "spot" coal purchased to cover contract shortages resulting from these conditions has been exorbitantly high in price and most unsatisfactory in quality.

Little coal was received on regular contract from the beginning of the strike until August.

UTILITIES REQUIRE COAL OF RIGHT QUALITY

To the electric utilities the question of quality of coal is a particularly serious one. In large electric power plants the kind of fuel which is usable is dependent in large measure upon the design of boilers, stokers, ash-handling equipment, etc. Utility plants are designed and installed with a view to quality and quantity of fuel, and when the coal is not of the character for which the plant was specifically designed serious difficulties result in the form of deteriorated equipment, reduced outputs or even complete shutdown.

The actual value of the coal for steam-making purpose declines rapidly with large ash content, and thus it is with great difficulty, if at all, that the outputs can be maintained when coal of inferior preparation and quality must be used. The following figures give the results of a test of Illinois coal of varying ash content under a standard boiler:

Percentage Ash in Dry Coal	Horsepower	Percentage Efficiency
9	690	61
24	615	51
35	227	30

It is important to obtain coal complying with a specific analysis from another point of view—the availability of coal for storage. Some coals, while they may be satisfactory in other respects, are unavailable for storage in considerable piles, as becomes necessary where large quantities are involved, owing to the danger of spontaneous combustion. When we have been compelled to accept unsuitable coals, we have frequently had two or three fires going in our coal piles, necessitating rehandling and restacking of the coal with a serious loss due to coking. Owing to the high temperature attained it is also difficult to transfer such coal into barges, the bottoms often burning through, which results in a complete loss of the coal as well as the barge. Coal which is liable to spontaneous combustion also causes extreme difficulty when deposited in the relay bunkers situated immediately above the boilers in the very center of the power houses where a fire is difficult to get at.

Utilities must be provided with fuel of a reasonably definite quality that they can use efficiently, and they have not been adequately cared for when they have been merely provided with some coal. The experience of the utilities covering several years has demonstrated that much unsatisfactory and grossly inferior, badly prepared coal is shipped during periods of fuel and transportation stringency. This not only reduces plant capacity but absorbs railway equipment unnecessarily.

SOME PROPOSED REMEDIES

Various remedies have been proposed for stabilizing the coal business, though as yet the United States Coal Commission, after several months of intensive study, has not been convinced that a proper solution has been found.

One important group of those interested advocate in essence that the situation be allowed to work itself out without external government or other interferences under the ordinary laws of competition and of supply and demand.

A second suggestion is that the government itself purchase and operate the mines. This plan, though vigorously and continuously promoted by a group of the more radically inclined, has been almost universally condemned by the public on the ground that government ownership and operation has not proved either efficient or economical, and experience with the railroads under government management has not been such as to encourage further experimentation in that direction.

Finally, plans have been proposed whereby through the extension of the storage of coal by all users, by the seasonal variation of prices of coal and possibly seasonal variation of freight rates, by conservation or economy in the use of coal, and by simplifying its distribution, conditions can be materially improved.

Of the methods for ameliorating fluctuating conditions in the coal industry, the proper use of storage seems to offer exceptional advantage. The public utilities for self-protection early inaugurated the policy of maintaining generous storage of coal at their plants. Indeed, they have been leaders in this regard, and through wise buying and handling of storage have proved to be a helpful stabilizer to the coal industry. The large amounts of coal they put in storage prior to the beginning of the great coal strike on April 1, 1922, were a material element in saving the country from a catastrophe of large dimensions.

The following table of days' supply the utilities and all users had on hand in the country at various dates is significant:

	1922		1923,
	March 1	Oct. 1	Jan. 1
Coal-gas plants	82	38	60
Electric utilities	54	3	33
All users	43	21	26

Larger storage capacities for all coal users, to be filled at times during the year when transportation facilities are best available, would do much to remedy

the present unsatisfactory fuel conditions. The railroads themselves should, in as great measure as possible, haul and store the coal for their own needs during periods when their facilities are not pressed by peak loads.

Further, the mines can in a certain measure promote storage which would prevent the irregular daily production outputs caused by variations in daily car supply. In many locations a coal pocket holding from one to two days' output may be installed at a moderate expense and so arranged as to discharge directly into the railroad cars with little additional equipment and no additional handling. Such a storage should enable the mine to run continually at least five days per week, and the slight additional cost would be largely overbalanced by improved showing in the overhead per ton of coal produced.

Application of electrical equipment in coal mines, while showing steady progress, has not yet reached the rapid development that was to be expected. Electric haulage was reported as in use in 46 per cent of the coal mines reporting, with 11,265 motors, and 51 per cent of the mines used electric cutting machines, although animal haulage and hand methods of mining still prevail to a surprising extent. Of the 3,054,000 hp. used in the anthracite and bituminous industries, about 1,383,000 hp. represented power produced by prime movers at the mines and 888,000 hp. motors operated by purchased power.

POWER STATIONS AT MINES

It has frequently been suggested that much expense and transportation difficulty could be saved to the electric utilities and steadiness of mine output could be promoted by the location of generating stations at the mine mouth and the transmission of the power so generated to the point of use. This has been done in a number of cases in England, on the Continent of Europe and to some extent in America, and it has been found that wherever adequate water supplies exist for condensing purposes the installation has been successful. This condition, however, does not obtain in the majority of cases. Speaking broadly, it must be remembered that for every ton of coal burned in the power station from 600 to 1,000 tons of water must be provided for condensing purposes.

It is unfortunate that very few rivers of adequate size to provide this flow are available in the coal regions, and it is apparent that the object to be attained by placing the station in the coal region has in most cases been impossible of achievement.

The project of pumping coal through a pipe line has been considered by many engineers, and its feasibility has been shown, at least theoretically. The cost and design of the apparatus are well known, and no engineering difficulties are entailed in its operation. A proportion of 50 per cent by volume between material and water can be maintained. At 10 ft. per second, which is not excessive, a 14-in. pipe will carry more than 7,000,000 tons of coal per year, and this delivery is independent of the length of the pipe.

At the present time it is estimated that the cost of delivering a ton of coal, including fixed charges, from Scranton to the New Jersey side of the Hudson would probably not exceed 50 cents per ton, to which would have to be added the ordinary charges for lighterage and handling in the port of New York. It is also probable that bituminous coal could be pumped from either the Broad-Top or Clearfield region with equal facility, but at an increased cost of say $1.25 per ton, although this increase would be well within the cost of railroad freight. It has been estimated that approximately 18,000,000 tons or 20,000,000 tons of coal pass through New York City every year, which would absorb the capacity of three 14-in. pipes.

An advantage of all stabilization methods is that they will tend to furnish more continuous employment to miners and thus improve the economic and social conditions of the mine workers.

COAL CONSERVATION-SUPERPOWER SYSTEMS

America is notorious for her extravagance in the use of coal. Moves made to conserve this vitally important natural resource are wise for the protection of the future of the country and also tend to relieve the strain of heavy coal transportation. The public utilities can be of exceptional service in aiding to accomplish this result.

The government Superpower Survey of the Atlantic Coast from Maine to Washington, the report on which was made in 1921, affords a view of what is possible in this regard. It is estimated that power in this region can be supplied with the use of about 2 lb. of coal per kilowatt-hour, as against nearly three times that amount at present. The savings to be obtained would come largely through the possibility of the erection and efficient use of large, highly economical, suitably located power stations, taking advantage of the diversity factor in the varied industries of the several districts covered, lessening the reservation of spare equipment, making possible the electrification of railroads, and so on.

The building of great power systems, interconnected, as contemplated, by the Superpower Zone would make possible utilization of many water powers which otherwise would stand idle.

The electric and gas utilities offer an exceptionally effective medium for simplifying the transportation and distribution of coal. Though this phase of the coal distribution problem is seldom discussed, it nevertheless is one of great and growing importance.

In the power zone heretofore referred to are to be found more than seventy-six thousand industrial plants which use power. Five or six thousand of these use water power as their prime mover, but the great bulk are operated by power generated from steam. If these seventy thousand minor establishments obtained coal for generating their own power, large fuel shipments would have to be sent to seventy thousand points, requiring the time of locomotive and car equipment, and this would involve a material increase in shifting and switching.

However, as about one-third of the power required by these seventy thousand plants is supplied by central power stations, the amount of this detailed coal distribution and local delivery is materially reduced, as this power is generated from coal delivered at a few conveniently located central stations which have available the best modern coal-handling apparatus and commodious storage facilities. Thus today a very material measure of relief has been afforded the railroads through this centralization of coal delivery. If the transfer of the industrial plants of the country is continued, eventually the great bulk of the industrial power coal will be delivered to a few super-plants of great interconnected superpower systems.

It is evident that the public utilities hold wonderful opportunities for advancing the welfare of the nation through the conservation of coal and oil, simplifying the distribution of fuel, contributing to its conservation by the utilization of water power, and providing a supply of abundant, reliable and cheap power to our industries.

In order that their full value may become available to the nation, great systems covering large areas and supplying great loads will be necessary. To accomplish this purpose the utilities must continually expand, ever developing larger and more extended systems. This development is one of state-wide importance, and such public regulation as is needed should be of a state-wide character. Systems of this kind already include scores and hundreds of municipalities within their transmission areas, but they necessarily must be operated as a unit. It is impossible for them to develop or give good service to the public if they are subject to the harassing interference of all of the municipal or minor political establishments through which they may extend and in which they operate. Nor will such a consummation as the public desires and the companies wish to provide be possible unless state-wide regulation of a broad and equitable character is maintained and the laws and rulings governing the utilities are of a helpful and stable character and such as to attract the large quotas of capital which it is necessary to obtain each year to provide for the rapid extension of the public utilities in order that they may serve the public adequately, efficiently and economically.

Automatic Start Reduces Surges

Rotor with Two Windings of Different Resistances on 10-Hp. Induction Motor Brings Static Current Down from 550 to 260 per Cent of Full Load Current—Field of Application

TO KEEP down the excessive static current in induction motors without requiring extra compensating equipment has been one reason for the development of the automatic-start polyphase induction motor. A paper on this subject presented before the American Institute of Electrical Engineers by James L. Hamilton, chief engineer Century Electric Company, St. Louis, discusses this development from both mechanical and electrical standpoints.

The stator of this motor is similar to those of other induction motors, but the motor has two windings—one being a progressively wound, low-resistance winding connected to a short-circuiting device, while the other is a high-resistance squirrel-cage design. The high-resistance winding is usually placed near the surface of the armature, thus giving minimum reactance. It can be proportioned to give high static torque with low static current. The low-resistance winding is usually placed deeper in the armature or beneath the high-resistance winding and as a result would have high reactance at standstill due to primary frequency in the armature. However, near synchronism, the frequency in the armature being low, the low-resistance winding also has low reactance; hence good running conditions result.

The motor starts as an induction motor with only the high-resistance armature winding in circuit, thus permitting low static current and high static torque. After the motor has attained a predetermined speed, the low-resistance winding is short-circuited, thus permitting the motor to run with all the rotor copper in circuit, giving small slip, high efficiency and high power factor. The starting winding can be designed for a maximum static torque for a given current, thus limiting the starting current. The running winding can be designed for the best running conditions when the motor attains speed. This type of motor, therefore, has the desirable characteristics of a very high-resistance squirrel-cage motor at starting and the desirable characteristics of a low-resistance squirrel-cage motor when running.

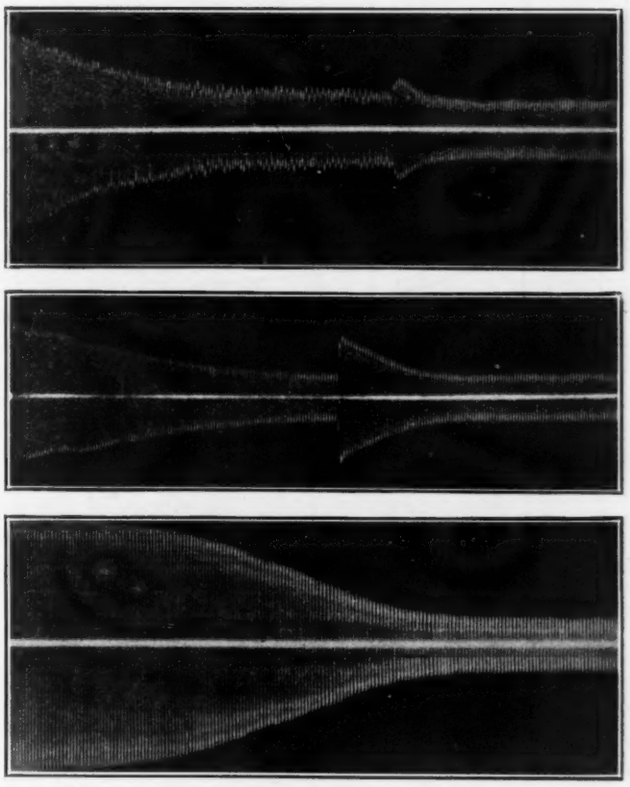


FIG. 1—STARTING CURRENTS FOR SINGLE-PHASE REPULSION-START, THREE-PHASE AUTOMATIC START AND THREE-PHASE SQUIRREL-CAGE MOTORS

		Amperes			
Oscillogram	Motor Data	Static	When Governor Operates	Per Line	Full Load Equivalent Single Phase
Above—	10-hp., 440-volt, 60-cycle, four-pole, single-phase repulsion start induction motor.....	72	42	24	24
Center—	10-hp., 440-volt, 60-cycle, four-pole, three-phase, automatic-start induction motor.....	60	54	12.5	21.5
Bottom—	10-hp., 440-volt, 60-cycle four-pole, three-phase squirrel-cage induction motor..... (without compensator)	105		12.5	21.5

A study of the static torque and current for various classes of direct-current and alternating-current motors is presented in Fig. 3. From these data it is seen that approximately the same low static current for a given static torque may be obtained from direct-current motors with starting resistance, from single-phase motors of the repulsion-start type, from polyphase induction motors with manually operated resistance in the rotor, and from the automatic-start polyphase induction motor. With a three-phase motor the starting current was reduced from 550 to 260 per cent full-load current with this automatic start, compared with the results obtained using a standard motor without starter.

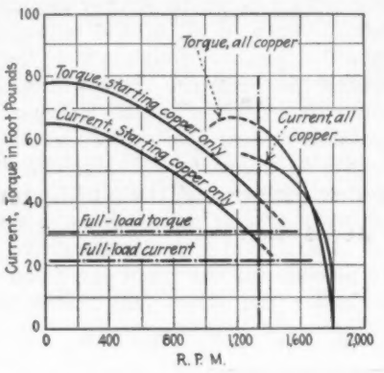


FIG. 2—STARTING CHARACTERISTICS OF 10-HP. INDUCTION MOTOR

From experience it has been found that a static torque of 175 to 250 per cent of full-load torque is desirable to break the static friction of machinery or apparatus. Since the automatic-start polyphase motor takes a minimum of current from the line during the starting period for a satisfactory static and starting torque, it has been considered favorably by some central stations because it reduces the starting load period. The starting currents are predetermined and cannot be changed by an inexperienced operator.

A representative curve on starting characteristics is given in Fig. 2 for a 10-hp., 440-volt, four-pole, 60-cycle induction motor. These curves have been plotted from observed readings on the motor. The static torque in this case is 75½ lb.ft., or 250 per cent of full-load torque, with a static current of 65 amp., which is 300 per cent of full-load current. The National Electric Light Association states that 75 per cent of the locked rotor current is considered as the starting current, so that the so-called starting current of this motor would be 75 per cent of 65 amp., or 49 amp.—250 per cent of full-load current. As noted in Fig. 1, the starting winding has a maximum torque at or near standstill, which gives the maximum torque efficiency at this point. If the starting winding of higher resistance is used to obtain lower static current, the amount of load the motor can bring up to speed will be reduced. It is always desirable to have no greater current flow when the governor short-circuits the running winding than flowed at the moment of connecting the motor to the line. While the starting copper resistance is nine times the stator resistance, the running rotor resistance is practically only twice the stator resistance. Therefore, the starting copper winding has a resistance of four and one-half times the running rotor resistance.

The weight and size of this type of induction motor for a given speed and rating are practically the same as for a direct-current or a polyphase wound-rotor slip-ring type induction motor.

The automatic-start polyphase induction motor is well adapted for operating various kinds of machinery having considerable inertia, or loads that are difficult to start from rest. It is also suited for the operation of machinery where the motor would not be under constant supervision of an operator. It can be started on a fuse or other protective device which will protect the motor under operating conditions. A fuse of 120 per cent of rated current of the motor is usually quite large enough, while a fuse as large as 150 per cent of rated current of motor is never needed.

The oscillograms and the table in Fig. 1 show the starting point for three different types of motors, a single-phase repulsion start, a three-phase automatic start and a three-phase squirrel-cage induction motor without compensator. In this last-named motor it can be seen that the static current swings up to 105 amp., while the automatic-start induction motor had an amperage of only 60.

The starting efficiency of the automatic-start polyphase induction motor is substantially the same as for shunt or a compound-wound direct current, a polyphase slip-ring motor with resistance in rotor starting and a single-phase repulsion-start induction motor. In all sizes this type of motor may be started by closing the switch without the use of a starter as it takes not over 300 per cent of full-load current and has a static torque of about 250 per cent of full-load torque.

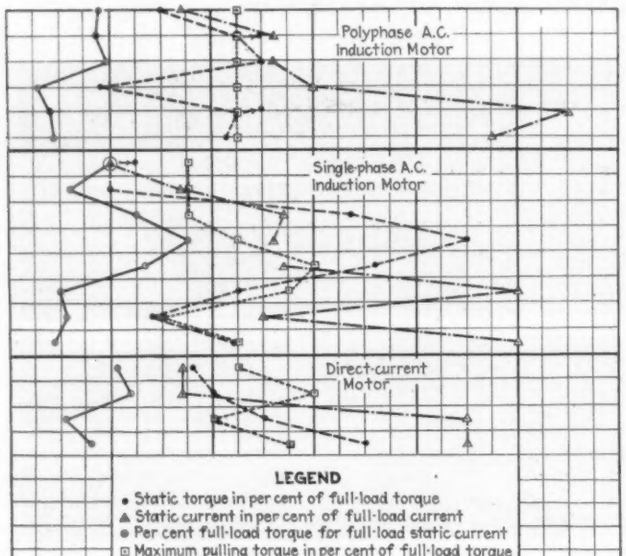

Polyphase A.C. Induction Motor
Single-phase A.C. Induction Motor
Direct-current Motor
LEGEND
• Static torque in per cent of full-load torque
▲ Static current in per cent of full-load current
● Per cent full-load torque for full-load static current
⊡ Maximum pulling torque in per cent of full-load torque
100
200
300
400
500
600
Per cent of full load current and torque

FIG. 3—STUDY OF THE STATIC TORQUE AND CURRENT FOR VARIOUS CLASSES OF MOTORS

TOP SECTION—POLYPHASE ALTERNATING CURRENT INDUCTION MOTORS

Four symbols on uppermost line of diagram: Two-phase or three-phase, wound rotor, 5 hp. with starting resistance.
Second line: Two-phase or three-phase, automatic start, wound rotor, 15 to 50 hp.
Third line: Two-phase or three-phase, automatic start, wound rotor, ½ to 10 hp.
Fourth line: Two-phase or three-phase, squirrel cage with compensator, 7½ hp.
Fifth line: Three-phase, squirrel cage, no compensator, ½ to 10 hp.
Sixth line: Three-phase, squirrel cage, no compensator, ¼ hp.

CENTER SECTION—SINGLE-PHASE ALTERNATING-CURRENT INDUCTION MOTORS

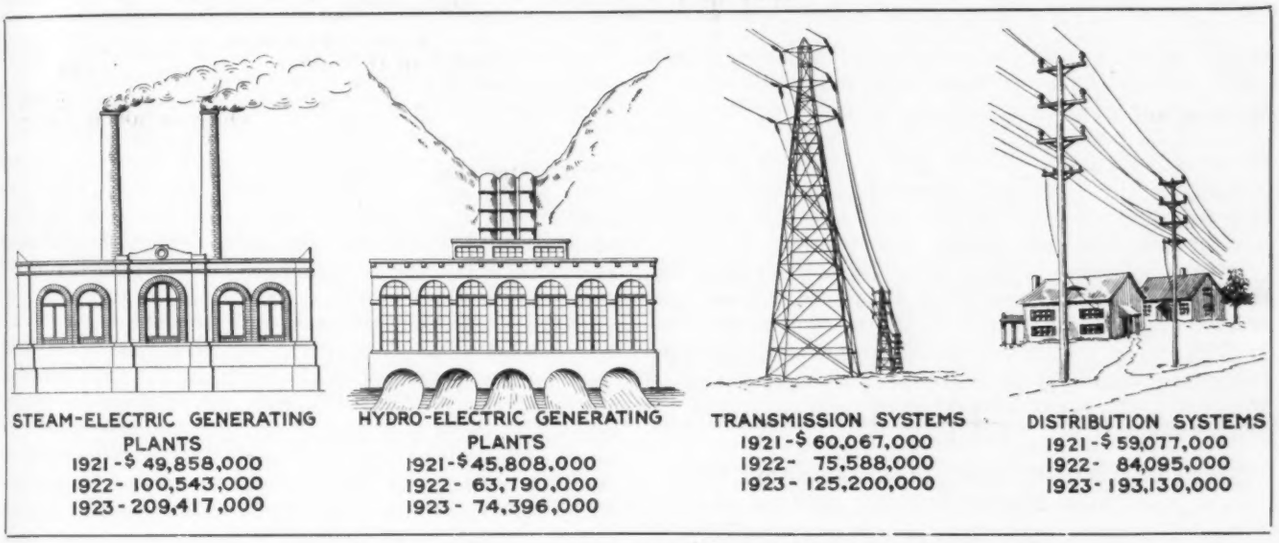
Symbols in first row of squares across diagram in this section: 7½-hp., repulsion start, with compensator starter.
Second row: 7½-hp., repulsion start, with resistance starter.
Third row: ½ hp., repulsion start.
Fourth row: ⅛ to ½ hp., repulsion start.
Fifth row: 1 hp., repulsion, weakly compensated.
Sixth row: 15 hp., repulsion, strongly compensated.
Seventh row: 15 hp., with R and X_L start.
Eighth row: ½-hp. split-phase start.

BOTTOM SECTION—DIRECT CURRENT MOTORS

Symbols in first row of squares across diagram in this section: ½-hp. shunt, with starter.
Second row: ½-hp. compound, with starter.
Third row: ½-hp. compound, without starter.
Fourth row: ½-hp. shunt, without starter.

Additions and Extensions During 1923 Estimated at $602,143,000

"Electrical World" Survey Indicates that 2,890,400 Kw. Will Be Added to Generating Plants by Central-Station Companies—Value of Extensions to Distribution and Transmission Systems Estimated at $318,330,000



VALUE OF PROPOSED ADDITIONS AND EXTENSIONS DURING 1923 EXCEEDS ONE-HALF THE TOTAL GROSS REVENUE FOR 1922

A HIGH degree of expansion in an industry is an excellent indication of prosperity in that industry. When expansion follows a period of general industrial depression and takes on the attributes of high records, then general conditions in that industry may well be considered as of the highest order. Such are the conditions to be found in the electric light and power industry at the beginning of 1923.

Ever since its birth in 1882 the industry has spent annually an always increasing amount for additions and extensions to take care of the constantly growing demand for electrical energy. During the recent period of high prices and high cost of money it was financially impossible for the central generating and distributing companies to make any but the most necessary extensions and additions to equipment. With the recession of exceedingly high costs and the possibility of once again borrowing money at a reasonable rate of interest, the industry has laid plans for record additions and extensions to equipment during 1923. The extent of the large expendi[illegible] be made in the present year is indicated by [illegible] which has just been completed by the ELECTRICAL [illegible]. Returns were received from more than two hund[illegible] companies, representing about 70 per cent of the installed generator rating of the country.

The total value of the additions that will be made to the central generating, transmission and distribution systems during the present year is estimated at $602,143,000, which is $278,127,000, or about 86 per cent greater than the estimated expenditures made during 1922, and $387,325,000, or about 180 per cent more than the 1921 expenditures.

The estimated new generating installations during 1923 total 2,890,400 kw., of which 1,987,400 kw., or about 68.8 per cent, will be for steam-electric plants and 903,000 kw., or about 31.2 per cent, for hydro-electric plants. In 1922 it was estimated that 1,772,000 kw. was added to the generating equipment of the central stations, of which about 58 per cent was for steam-

TABLE I—VALUE OF PROPOSED ADDITIONS TO ALL CENTRAL-STATION GENERATING AND DISTRIBUTING SYSTEMS DURING 1923 AS ESTIMATED BY "ELECTRICAL WORLD"

Section	Steam-Electric Generating Plants	Hydro-Electric Generating Plants	Total Value of Additions to Generating Plants	Transmission Systems	Distribution Systems	Total Value of Extensions to Transmission and Distribution Systems	Total Value of All Estimated Additions During 1923
New England States	$6,270,000	$4,626,000	$10,896,000	$6,680,000	$7,420,000	$14,100,000	$24,996,000
Middle Atlantic States	66,800,000	11,300,000	78,100,000	31,200,000	76,900,000	108,100,000	186,200,000
South Atlantic States	22,700,000	10,000,000	32,700,000	11,920,000	12,340,000	24,260,000	56,960,000
North Central States	107,900,000	5,180,000	113,080,000	44,800,000	48,300,000	93,100,000	206,180,000
South Central States	1,455,000	4,490,000	5,945,000	9,970,000	9,230,000	19,200,000	25,145,000
Mountain States	802,000	4,000,000	4,802,000	610,000	2,240,000	2,850,000	7,652,000
Pacific States	3,490,000	34,800,000	38,290,000	20,020,000	36,700,000	56,720,000	95,010,000
Totals for United States	$209,417,000	$74,396,000	$283,813,000	$125,200,000	$193,130,000	$318,330,000	$602,143,000

TABLE II—ESTIMATED EXTENT AND VALUE OF ADDITIONS AND EXTENSIONS TO CENTRAL-STATION GENERATING PLANTS DURING 1921, 1922 AND 1923

Section	Steam-Electric Generating Plants						Hydro-Electric Generating Plants					
	Estimated Additions During Year			Estimated Value of Proposed Additions			Estimated Additions During Year			Estimated Value of Proposed Additions		
	1921 (Kw.)	1922 (Kw.)	1923 (Kw.)	1921	1922	1923	1921 (Kw.)	1922 (Kw.)	1923 (Kw.)	1921	1922	1923
New England States	236,000	76,000	151,200	$8,085,000	$5,870,000	$6,270,000	18,700	39,000	24,000	$1,480,000	$3,690,000	$4,626,000
Middle Atlantic States	102,000	332,000	678,000	10,430,000	41,250,000	66,800,000	23,300	256,000	180,000	2,458,000	7,240,000	11,300,000
South Atlantic States	106,000	76,000	200,000	5,004,000	6,890,000	22,700,000	.....	222,000	240,000	.....	10,900,000	10,000,000
North Central States	404,000	388,000	867,500	22,020,000	34,700,000	107,900,000	60,000	78,000	64,000	2,680,000	9,800,000	5,180,000
South Central States	15,000	78,000	29,100	1,920,000	6,460,000	1,455,000	30,000	32,000	90,000	1,110,000	6,000,000	4,490,000
Mountain States	1,000	20,000	16,800	72,000	828,000	802,000	2,200	.....	25,000	58,000	310,000	4,000,000
Pacific States	37,500	58,000	44,800	2,327,000	4,545,000	3,490,000	216,000	117,000	280,000	38,030,000	25,850,000	34,800,000
Totals for United States	901,500	1,028,000	1,987,400	$49,858,000	$100,543,000	$209,417,000	350,200	744,000	903,000	$45,808,000	$63,790,000	$74,396,000

electric plants and 42 per cent for hydro-electric plants, while in 1921 it was estimated that only 1,251,000 kw. in generator equipment was installed during the year, of which 72 per cent was for steam-electric plants and 28 per cent for hydro-electric plants. The new generator installation in 1923 will, therefore, probably exceed that of 1922 by about 63 per cent and that installed during 1921 by about 131 per cent.

It must be borne in mind in studying these data that the estimates are for additions to generating and distributing systems which were operating prior to Jan. 1, 1923, and do not include the systems of new operating companies organized during 1923, the expenditures of which are, of course, impossible of computation at the present time.

VALUE OF STEAM-ELECTRIC PLANT ADDITIONS MORE THAN DOUBLE THAT IN 1922

The returns received from the survey indicate that the value of the proposed additions to steam generating plants during 1923 will total $209,417,000, or a little more than twice the expenditures estimated in connection with this type of plant during 1922 and more than four times the steam-plant expenditures in 1921. The rating of the new generators to be installed in steam-electric plants during the present year is estimated at 1,987,400 kw., which is about 93 per cent over that estimated for 1922 and about 120 per cent over the 1921 new generator installation in steam-electric plants. No relation, however, can be said to exist between the value of the additions to steam-electric generating plants and the kilowatt rating of the new generators to be installed. Many companies reported extensive expenditures for new buildings, boilers, stokers, switches and protective equipment without any increase in the generator equipment.

While the net investment involved in hydro-electric projects in course of construction under licenses from the Federal Power Commission totals about $202,300,000, it must be remembered that that figure includes the cost of transmission systems involved in these developments and also that only a portion of this new development will be completed during the present year. Returns received in the ELECTRICAL WORLD survey indicate that during 1923 about $74,396,000 will be spent for new hydro-electric plants or additions to old plants, exclusive of the cost of transmission systems leading from such plants. In 1922 it was estimated that $63,790,000 would be spent in hydro-electric development, and in 1921 $45,808,000. Though the value of additions to hydro-electric plants appears to have increased yearly, yet the rate of increase is materially below that reported for additions to steam-electric plants.

The total value of extensions to the transmission and distribution systems of the country during 1923 reaches the high figure of $318,330,000. Extensions to transmission systems will total about $125,200,000, which is about fifty million dollars over the estimated value of the 1922 extensions. The estimated value of expenditures for extensions to the distribution systems of the country reach $193,130,000, or about two and one-third times the estimated value of extensions to distribution systems during 1922. These record-forming proposed extensions to the distribution systems of the country are probably the most indicative to be found in the accompanying tabulation. The crux of central-station operations is the ultimate consumption of the generated energy by the consumer. The record extensions to distribution systems reported from every section of the country are clear indicators of the extent to which the electric light and power industry is weaving itself into the domestic and economic fabric of the nation.

The North Central States lead in total value of proposed additions and extensions during 1923 with $206,180,000, of which 45.2 per cent will be spent for extensions to transmission and distribution systems and 54.8 per cent represents the value of additions to generating plants. The Middle Atlantic States and the Pacific States follow with $186,200,000 and $95,010,000 respectively. In the case of the Pacific States almost 60 per cent of the total expenditures is for extensions to transmission and distribution systems, this item totaling $56,720,000.

TABLE III—ESTIMATED VALUE OF ADDITIONS AND EXTENSIONS TO CENTRAL-STATION TRANSMISSION AND DISTRIBUTION SYSTEMS DURING 1921, 1922 AND 1923

Section	Value of Extensions to Transmission Systems			Value of Extensions to Distribution Systems			Value of Extensions to Transmission and Distribution Systems		
	1921	1922	1923	1921	1922	1923	1921	1922	1923
New England States	$1,440,000	$2,570,000	$6,680,000	$2,629,000	$3,095,000	$7,420,000	$4,069,000	$5,665,000	$14,100,000
Middle Atlantic States	8,240,000	20,130,000	31,200,000	8,374,000	17,680,000	76,900,000	16,614,000	37,810,000	108,100,000
South Atlantic States	6,197,000	5,140,000	11,920,000	3,570,000	5,045,000	12,340,000	9,767,000	10,185,000	24,260,000
North Central States	20,510,000	22,000,000	44,800,000	22,690,000	30,200,000	48,300,000	43,200,000	52,200,000	93,100,000
South Central States	2,230,000	4,150,000	9,970,000	2,220,000	5,220,000	9,230,000	4,450,000	9,370,000	19,200,000
Mountain States	.....	148,000	610,000	117,000	955,000	2,240,000	117,000	1,103,000	2,850,000
Pacific States	21,450,000	21,450,000	20,020,000	19,477,000	21,900,000	36,700,000	40,927,000	43,350,000	56,720,000
Totals for United States	$60,067,000	$75,588,000	$125,200,000	$59,077,000	$84,095,000	$193,130,000	$119,144,000	$159,683,000	$318,330,000

The Hope of Reward

By L. R. NASH
Stone & Webster, Inc., Boston, Mass.

SOME years ago the writer had on the walls of his office an old saying to the effect that "People who do what they get paid for generally get paid for what they do." This is an apt characterization of one of two classes into which those who toil either with hands or brain may be broadly divided.

The first class includes those who hold that the world owes them a living and that they are justified in giving the minimum in hours or effectiveness of work that will insure the holding of their jobs. The second class, with broader vision, holds that in the long run diligence and efficiency will be rewarded and that each day's work should embody the maximum of accomplishment or plans for future achievements.

Few of us realize the extent of individual responsibility for the world's welfare. We may admit that this welfare is measured by the total productivity of all industry, but we are apt to measure this total in terms of inventive genius and the ever-expanding application of machinery to even the simplest of daily tasks.

No one will deny that during the past generation the world has made its greatest progress in labor-saving devices, and yet the appalling fact remains that during that period there has been no appreciable increase in the per capita production of commodities useful in maintaining human life and comfort. This almost unbelievable situation has, by very careful statistical analysis, been shown to exist in the United States, and no other country in the world has shown greater application of machinery to industrial processes.

What is the reason for this stagnation in productivity after centuries of rapid progress? A searching study of the situation, however important and even imperative it may be, is not appropriate herein. Certain of the reasons, however, are obvious and are within the scope of this discussion. The period in question has witnessed a steady reduction in hours of daily labor. At its beginning ten hours or more was common practice. Now eight hours is fairly well standardized, and the workers in a few industries regard six hours as their goal. Certain trades have adopted the habit of school children by working only five days a week.

Reduced Working Hours Decrease Productivity

A reduction from sixty to forty hours of work per week is in itself sufficient to counteract a vast increase in productivity through use of machinery. But curtailment has not stopped there. The units of work per day or per hour have also been subject to drastic and artificial restrictions in many industries, as have also the kinds of work a particular individual is permitted to do. Coincident with these tendencies have come higher rates of wage and standardization of wages without definite recognition of wide ranges in skill within a particular industry.

The inevitable effect upon industry as a whole has been to increase costs of production. A part but not all of this increase has been offset by the use of machinery. For more than twenty-five years there has been a steady upward movement in prices, independent of the war increases. Those whose productivity has been curtailed, as well as others, have had to meet this increase, and they have, therefore, shared in the consequences of their own acts. Few thinking people now deny that reductions in hours of labor, manual or mental, have been beneficial to industry generally, as well as to the individuals directly involved, to the extent that efficiency and productivity have been increased; nor will it be denied that labor in many cases deserved an increased proportion of the value of the joint products of labor and capital. It is the arbitrary reductions and restrictions, benefiting neither industry nor individuals, that deserve unrestrained criticism.

The effect of restrictive methods upon the individual is more far-reaching than its drain upon his pocketbook. It does not take more than ordinary intelligence to recognize the dishonesty in accepting a day's pay for work that might be done in a half day, nor to see that a standardized wage is an averaging process under which the skilled workers help to support the incompetents. A competent worker thus restricted knows that his abilities are wasted, for not only does their full exercise, if permitted, bring him no more pay but it even draws out the reproaches of his less skilled fellow workers against such a proof of their own shortcomings.

In short, the tendencies of the day toward standardization and co-ordinated efforts are destructive of the highest moral standards and efficiency and of that individual incentive which is necessary for both. Any person working without stimulus or hope of reward beyond a fixed standard stipend is a drifter upon life's troubled waters and may become a dangerous derelict.

The proponents of collective methods and standardization claim that the gains which have been brought about justify the individual sacrifices which have been made. A careful study of wage history fails to disclose these alleged gains, but shows, on the contrary, that individual bargaining has brought greater gains in income than collective bargaining. Individual incentive with its hope of reward, contrary to popular impression, has proved more powerful than collective action without such incentive and hope. And this is as it should be; for, if our cherished American standards and traditions, so often praised and defended, mean anything, they mean a maximum of individual freedom and full opportunity for advancement financially, politically and socially.

THE foregoing comments, applicable broadly to all kinds of human activities, are merely the preamble or text for the real point of this paper. A rule that works well for individuals is apt to work equally well for groups of individuals. If a hope of reward serves as a desirable stimulus to one man, it will have a similar effect upon a business in which the energies of a number of men are combined. Business is very sensitive to opportunities for profitable expansion, as it is also apprehensive of possible burdensome restrictions. If the profits from business undertakings are in large part taken from the owners through taxation, or are kept within closely prescribed limits, the incentive for ventures into new fields and for aggressive developments and refinements in existing activities is destroyed. It matters not that such new activities might be of great or even revolutionary advantage to the world through new processes or commodities or lower costs of existing ones; the attendant risks will not be taken without the possibilities of unfettered commensurate reward.

In the pioneer days of steam railroads lines were pushed out into or through vast uninhabited areas in the hope that, after the inevitable years of losses, a liberal measure of compensating profit would follow. Why has railroad building in the United States virtually ceased during the last generation? Not because all actually or potentially productive sections have been reached, but, rather, because the undiscerning hand of regulation has withdrawn the possibilities of reward which alone appeals to hardy, adventurous spirits. A return of not more than 5 per cent upon investments in uncertain ventures has no appeal to a prospector who scorns the placid security of a savings bank.

Illustrations might be multiplied, almost without limit, of the steady encroachment of restrictive regulation in the field of commerce and industry, accompanied in most cases by withdrawal of incentive for aggressive activity, and followed by a spiritless conservatism which no longer seeks or expects anything more than conventional compensation for a standardized product. Progressive business, as well as red-blooded American citizens, will not be satisfied with such stifling of their ambitions and hopes of reward. They will either de-

stroy the unwise restrictions or, failing this, will withdraw to other fields not yet touched by the leveling process. It is to be hoped that the first course will prevail.

This is not a condemnation of public regulation, but only a criticism of certain phases of it in which the phenomena above discussed have been in evidence. Those of us who are engaged in the public utility field have not yet realized the results of the standardization of regulatory methods which is gradually becoming effective. The public service field is still comparatively new, and the pioneer spirit and enthusiasm for progress have not yet yielded to conventionalizing influences. However, if the influences continue, the yielding is inevitable.

A more specific statement with respect to regulatory methods as applied to public utilities is now necessary in order that the corrective measures which this paper proposes may be more intelligently considered. The most common exercise of regulatory powers is in the fixing of rates. The almost universal rule is that rates should be sufficient to cover the cost of the service rendered, including operating expenses, taxes, depreciation and a reasonable return upon the fair value of the property employed in the service. It is customary to accept actual operating expenses and taxes and perhaps retirement annuities, if or when they have been shown to be reasonable.

Operating Efficiency Deserves Recognition

When, however, the value of the property and the proper rate of return thereon are considered, the commissions are apt to abandon specific inquiries and adopt a standard procedure. For example, a uniform return of 8 per cent may be declared reasonable, at least for utilities of a particular kind, without due regard for the risks of the particular enterprises and the efficiency with which its operations are conducted. Operating ratios of public utilities may differ by as much as 25 per cent under apparently similar conditions; the return demanded by investors may vary an even greater amount. In either case the difference may be due, in large part at least, to business skill or the lack of it in the management of the properties. It does not seem reasonable to permit widely different rates for different utilities when the entire difference may be due to varying skill in the construction or handling of the properties. Under competitive conditions no such variation in charges would be possible, for the business under higher rates would soon disappear.

Under regulation, which is merely a means of securing competitive results in monopolistic business, such differences could be adjusted by establishing a reasonable standard of business skill, presumably materially higher than that of the least efficient company and assuredly lower than the most efficient. A premium for efficiency and a penalty for inefficiency would thereby be created, serving a very useful purpose. Both penalties and premiums would lead to better results, with the weight of advantage in favor of the premiums. Without them there is lacking a natural, sustained incentive for improvement. Public utility executives will not in the long run make strenuous efforts to improve and expand their service if all the benefits derived therefrom are taken away from them and given to others. Why should they worry about lower cost and greater volume of business which do not add to their profits? Eighteen holes of golf on pleasant afternoons will prove much more interesting to them than saving a tenth of a pound of coal per kilowatt-hour for the benefit of their patrons.

That this principle is of broader application may be seen in an assumed case of a reasonably efficient street railway of the conventional type. An investigation shows that by the purchase of one-man cars the service of this railway can be improved and operating expenses reduced enough to pay a return on the added investment and provide a margin to amortize the investment in superseded two-man cars. If the proposed change in cars were made, a rate case might be brought and a finding made limiting operating costs to the new basis and the rate of return to the conventional amount on the "used and useful" property, excluding the unamortized superseded equipment. Surely with such possibilities there is no incentive to give better service, but, rather, a risk of serious loss.

If the above illustration is considered as extreme or unusual, a simpler and more conventional one may be substituted. Our assumed street railway, after strenuous past efforts to raise its power-station efficiency to the maximum possible limit, with no heat unit escaping without the closest scrutiny, may awaken to the fact that the kilowatt-hours so zealously produced are being handled rather carelessly after they leave the switchboard. It may find that, through a moderate investment in power-measuring devices on its cars, it can save 10 to 20 per cent of its entire station output. But the installation of these devices calls for some new money and also for a clerical and supervisory force which, if results are to be accomplished and maintained, may disturb the peaceful routine of some of the veterans on the front end of the cars and cause other annoyances. Why bother with the thing at all if the savings are all passed along to the other fellow? These and other more routine refinements in operating costs offer no advantages to the utility if they are to be wholly passed along to patrons through rate reductions as soon as they are discovered.

One more illustration, in this case from actual experience, may be cited to make clear the broad application of this principle to public utilities. Not long ago a large company became convinced, after careful investigation, that welfare activities and a program of death and disability payments would be a good investment through the increased efficiency and improved morale of its employees that would follow. After the company had spent considerable money in studying the plans adopted by other companies and in working out its own plans in the light of the most successful experience elsewhere, but before putting them into effect, its rates were the subject of an investigation by the public service commission. In its findings in the case the commission excluded from the cost of service all charges relating to the proposed welfare and pension program on the ground that such expenditures should not be reimbursed by customers unless or until the program had been put into effect and had proved profitable. It is not hard to forecast the policy of other utilities under the same jurisdiction with respect to such matters, however helpful they might think the final results would be to company, employees and public. With their own initial investment in jeopardy and no ultimate financial gain possible, the unanimous verdict would be "nothing doing."

The situations here illustrated are perfectly analogous to that of the individual who is assured of a standard wage so long as he renders reasonable service. In either case service would be better or greater if the reward were in proportion to the effort and ability to serve. The remedy in the case of the individual is simple in principle, although it involves practical difficulties of application. A suitably adjusted reward for business administration of a high order is not so simple in principle, although it has possibly fewer difficulties of actual application.

A number of regulatory commissions have reduced the authorized return upon public utility property as a penalty for mismanagement or inefficiency. A few others have commended unusual administrative ability as being worthy of reward but have not put the reward in tangible form. The suggested method of award has usually been a higher rate of return, and this appears in imperfect form in several service-at-cost franchises and in the so-called "sliding scale." A greater refinement in this factor might include the value of the property on which the return is based, with particular reference to the basis of valuation and certain intangible elements which are often subjects of controversy. Another real incentive would be found in the establishment of a standard of operating cost, the savings under which would belong wholly or in part to the utility.

The difficulty attending the practical application of such an incentive program lies in the exceptional ability, good judgment and intimate knowledge on the part of the regulatory bodies required for its equitable adjustment in each of the many and diverse cases which would arise. One of the state commissions* has recently developed an interesting system of grading public utilities. This system, which furnished the original motive for this paper, sets up an extended list of factors and elements which are concerned in the furnishing of satisfactory service to the public. The items are given varying weights, depending upon their importance, in determining the final standings of the various utilities. The system has the imperfections to be expected in a pioneer effort of its kind, and the purposes of the grading have not been disclosed. It is doubtful if any system of rating can be devised which would even approximately measure the over-all excellence of a complex business. The more complications are encountered, the less opportunity there is for helpful application of rules and formulas and the greater the need of broad, unrestricted judgment.

MERIT SYSTEM NEEDS CONSIDERATION

In spite of these fundamental limitations to a rating or merit system, the increasing need of it in the public utility field justifies a most careful study of its possibilities by all regulatory commissions and its tentative application at an early date. Regulation is still in its development stage and the commissions have much to learn from the results of their past practices before a stable, consistent policy can be established. With due deference to the earnest efforts of the commissions to deal justly with both public and utilities, it is submitted that too many restrictions have been placed upon values and returns thereon in rate cases. This element in the cost of service amounts ordinarily to from one-fourth to one-third of the total cost. A variation of 10 per cent in this element has a negligible effect upon the bulk of the utility's patrons. For customary individual or home service it would amount to less than 10 cents per month. On the other hand, this difference may in the aggregate mean to the utility good credit instead of inability to meet all capital needs, liberality in making service extensions instead of delays and restrictions, satisfactory and reliable service instead of breakdowns and irregularities, and, finally, an incentive to improvements and progress instead of discouragement and stagnation. Surely these differences are worth much more to customers than their trivial cost, and a recognition of this fact by the commissions would be of advantage to all concerned.

An increase in the rate of return by 1 per cent, or even less, in a few merited cases as a reward for earnest and successful efforts to render excellent service, and the recognition of such proceedings as a tentative standard by commissions generally, would go far toward reviving the old pioneer courage and aggressive spirit of the operators and to inspire new interest on the part of investors. Good public utility service is vital to any live community, and it should not be withheld for lack of a reasonable hope of reward.

*The Illinois Commerce Commission.

Accuracy and Vision Required*

Quite Often Insufficient Time Is Allowed Engineers in Which to Prepare Estimates Properly—Costly Errors from Too Great Haste

BY A. D. THRALL
Vice-President Minnesota Loan & Trust Company, Minneapolis

WERE I to be asked what I considered the most desirable qualifications in an engineer's report, I should reply, "Accuracy and vision." Have we not sacrificed more to speed in this country than really is necessary? The man who wishes to develop water power wants to do it all at once. The engineer must within a few days have his statistics prepared and in hand. He is supposed to be able to make soundings by guesswork that are absolutely perfect. His contours are expected to be drawn by the naked eye in a few moments. His costs must be estimated and be turned in before he actually has determined where his sand and gravel may be obtained. The proprietor wants to let the contract before the cubical contents of the structure or the general plan are finally determined. Isn't this a mistake? We cannot maintain this lavish expenditure of funds simply for the purpose of cheating time. We acquired the habit during the war. A minute then might have meant a hundred thousand lives, and we weighed lives against money, with the balance tipping always in favor of the former.

But the war was a lavish devourer of raw materials. It was a spender of men's labor, and there was a depletion of wealth such as never before had been known.

We became accustomed to get results in the shortest space of time, regardless of costs and very often without proper attention to preliminary details.

I have in mind a project where several million dollars was expended on a large power project before it was definitely known just what the flow of the stream had been. (I don't believe that today, years after construction, there are any definite data.) The consequence was that before the project was successful it was necessary

*Part of a recent address before the Engineers' Club of Minneapolis.

to build a large steam auxiliary to produce sufficient power to carry on the enterprise. Only during three or four months a year was the water power up to the capacity of the plant. Here was a waste of many hundreds of thousands of dollars caused by lack of an engineer's report and by accepting insufficient and unauthenticated figures.

We are all acquainted with projects built during the last two or three years that have been estimated on the basis of a dollar and have cost on the basis of two dollars. The usual calm excuse has been that it was the rise in price of commodities and of labor that caused the discrepancy, but the wildest stretch of the imagination could not cause the mere price of commodities to double the cost of a project within the limit of time that elapsed. There was more behind it than that. It was probably the speed at which the project had been planned, the fever under which everybody worked to complete the proposition, which caused many things to be left out of the calculations that, had time been given him, the engineer would have included. So that before we can have the accuracy that we need on the part of the engineer, or the financier, we must have patience on the part of the promoter.

One of the great reasons why it is so difficult just at the moment to get an entirely new project going is because of the uncertainty of the actual figures of cost. The individual investor is very loath to hazard his funds in any enterprise the cost of which is not assured. Before we can effect a complete cure of this condition the engineer must know that he has full time to finish his work thoroughly, so that, barring the slight variance in actual prices, he can figure very closely the cost of a project. The banker, on his part, must feel that the engineer has had sufficient time to insure that the figures submitted are the actual figures and that before the undertaking is completed there will not be added an additional 100 per cent of cost, the avenues for raising which have been closed. When confidence shall have been re-established, then again will the investors' money be available for new developments.

Not only is accuracy an essential, but there is that great intangible gift of vision. We all strive to get as broad a view as possible. To a few men it is given to see in front and behind, but the success of our personal achievement and of the country's commercial development depends upon the breadth of this view. We all know it, we all appreciate it, when we meet it, and we endeavor in every way to develop a broad view individually. It doesn't reside in figures, it is in the human element behind the figures, and when based upon sound judgment developed from reasonable deduction and not as the result of idealistic hopes it forms the basis of the most permanent kind of confidence.

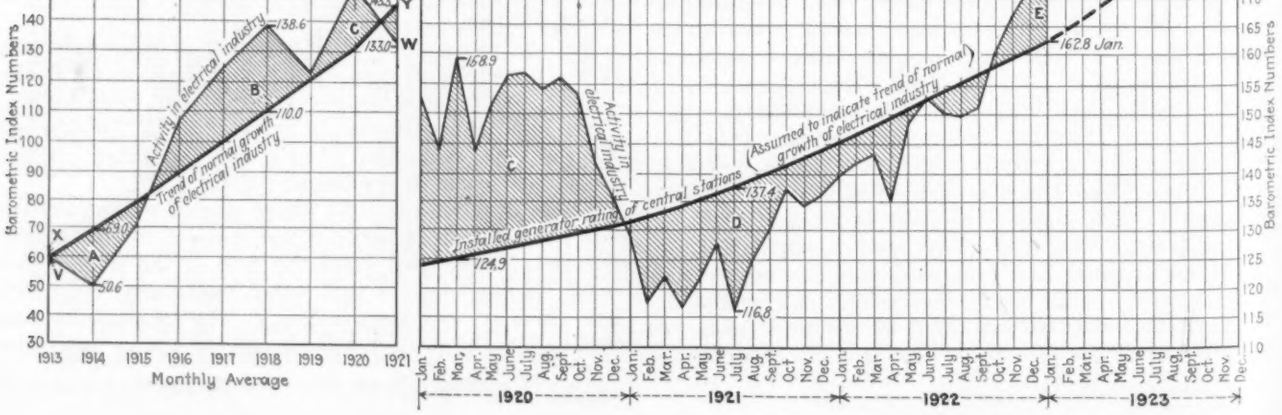
With this friendly interest fully developed, we shall at least make a beginning toward a condition of broader and wiser endeavor along those lines in which we are mutually interested.

Upward Trend Retarded During January

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indica'e that January activity within the industry was in excess of that of December, but that the upward trend was retarded during January as compared with the trend generally experienced by the industry since last September. The basic data indicate an increase of 3.2 points on the barometer scale as compared with December activities. The electrical industry as a whole was in January operating at 12.5 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In December it was operating at 11.2 points or per cent above the point of normal demand.

In its review of general business conditions the Harvard University committee on economic research has the following to say: "Developments in speculation and money during the first month of the year were favorable to the continuance of business advance, although the movements of the curves of our index charts are small. Speculation remains at the same level as in December. Actual commercial paper rates declined under seasonal influences by about the expected seasonal amount. These developments strengthened the probability that the expansion in business activity and the increase in wholesale commodity prices now in progress will be extended through the second half of 1923. With fundamental conditions in the money market unchanged during the next month or two, continuance of improvement in business throughout the year will be clearly forecast."

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS



Natural Gas as a Fuel for Central Stations

Unusually High Efficiency in the Burning of Natural Gas Has Been Developed with New Type of Burner—Long Life of Burner and Boiler Settings Are Assured with This Equipment

By E. A. QUINN
General Superintendent San Joaquin Light & Power Corporation, Fresno, Cal.

NATURAL gas as a fuel for central-station steam plants has failed to meet with the great degree of favor it should have enjoyed in sections where this fuel is available because of the very poor efficiency and short life of the ordinary types of burner that have been employed. The cost of fuel is the greatest single item of expense in the production of power and ranges from 40 to 70 per cent of the total cost. For this reason and because of the fact that all fuels are slowly but surely increasing in price larger investments in fuel-saving equipment are justified. In localities where a specific fuel is plentiful the problem resolves itself merely into a study of the best methods of burning this fuel. To the engineer efficient combustion means the chemical union of a substance with oxygen at such a rate as to cause rapid increase in temperature without waste. In the new Midway plant of the San Joaquin Light & Power Corporation a burner developed by the engineers of the company is in use which is giving efficiencies of 20,000 to 22,000 B.t.u. of natural gas as fired per kilowatt of electrical energy at the switchboard. This plant recently completed and placed in operation has a capacity of 25,000 kva. It is located near the oil fields of Kern County, California, and is the third plant on the system of this company in which natural gas is burned under the boilers.

GAS QUALITY AND PRESSURE VARY

Gas varying from 900 B.t.u. to 1,080 B.t.u. per cubic foot, depending on the location of the wells where it is obtained, is purchased from a local gas company. It is delivered to the plant through a 10-in. welded steel-tube line, guaranteed to withstand a pressure of 500 lb. per square inch. The pressure of the gas delivered ranges from 150 lb. to as low as 7 lb. per square inch in extreme cases. There is no gas held in storage by either the gas company or the power company, and with the exception of what may be taken from the mains by pulling down the pressure there is no reserve to draw on. In this way a small amount of gas can be obtained in case of an interruption to the supply while the oil burners are hurried into action to prevent losing the load on the station. In view of the fact that the gas companies have no storage they desire a constant load and a uniform flow from the wells. Variation in the demand for gas entails a hardship on them and in some cases may injure wells. Flow meters of the orifice type are used to measure the gas delivered. The static and differential pressures are recorded on one chart, from which records the consumption is readily calculated by means of planimeter readings and standard tables. As the gas enters the company's property it is stepped down to 20 lb. or 25 lb. pressure by Chaplin-Fulton pressure regulators and is metered at this pressure.

At the Bakersfield plant there are two sources of supply, and after passing through the regulators the lines continue to the metering stations, where a tie connection parallels them so that the total gas may pass through either or both of the metering lines. In each of these lines there is provided a disk with a 4-in. orifice installed in a flange joint with Wescott differential connections. Meters are operated at their highest rating, cutting them in or out as the demand varies.

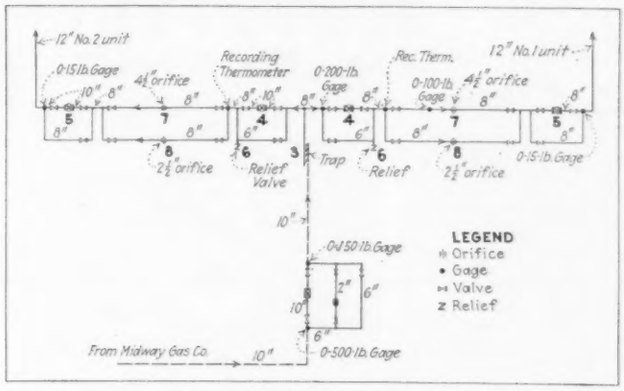


FIG 1—ARRANGEMENT OF METERING EQUIPMENT AT THE MIDWAY STEAM PLANT

After passing the meters the gas is reduced to a maximum of 2 in. of mercury and a minimum of 1½ in., at which pressure it enters the boiler-room header and is passed on to the boilers, being controlled at each boiler by a hand-operated gate valve. Just outside the power house traps are installed to collect oil, water or other residue which may have been carried over from the wells by the gas. These traps are so designed that it would seem impossible that they should not function properly. There are times, however, when the gas carries an oil vapor that will not be caught in any form of trap, and this vapor is carried past the traps and into the boiler-room gas piping and is apparently only given up when the pressure reaches the exceedingly low point at which it is sent directly to the burners. The first two boilers taking gas from the header get the greatest amount of this free oil. Each individual header is provided with drains to remove the oil before it reaches the burner tips.

Samples of gas are brought in twice daily from the Midway steam plant and tested for heating value, or B.t.u. content, and specific gravity. The gas is shipped in bottles made of 4-in. pipe, 30 in. long and tapering to a point at each end, with ⅜-in. nipple and valve attached. The gas is blown in one end and out the other until there is no doubt as to the contents being a true sample of the gas being delivered to the plant. The outlet valve of the cylinder is closed and the pressure allowed to build up to 200 lb. The inlet valve is then

closed and the cylinder immersed in water for the purpose of detecting leaks.

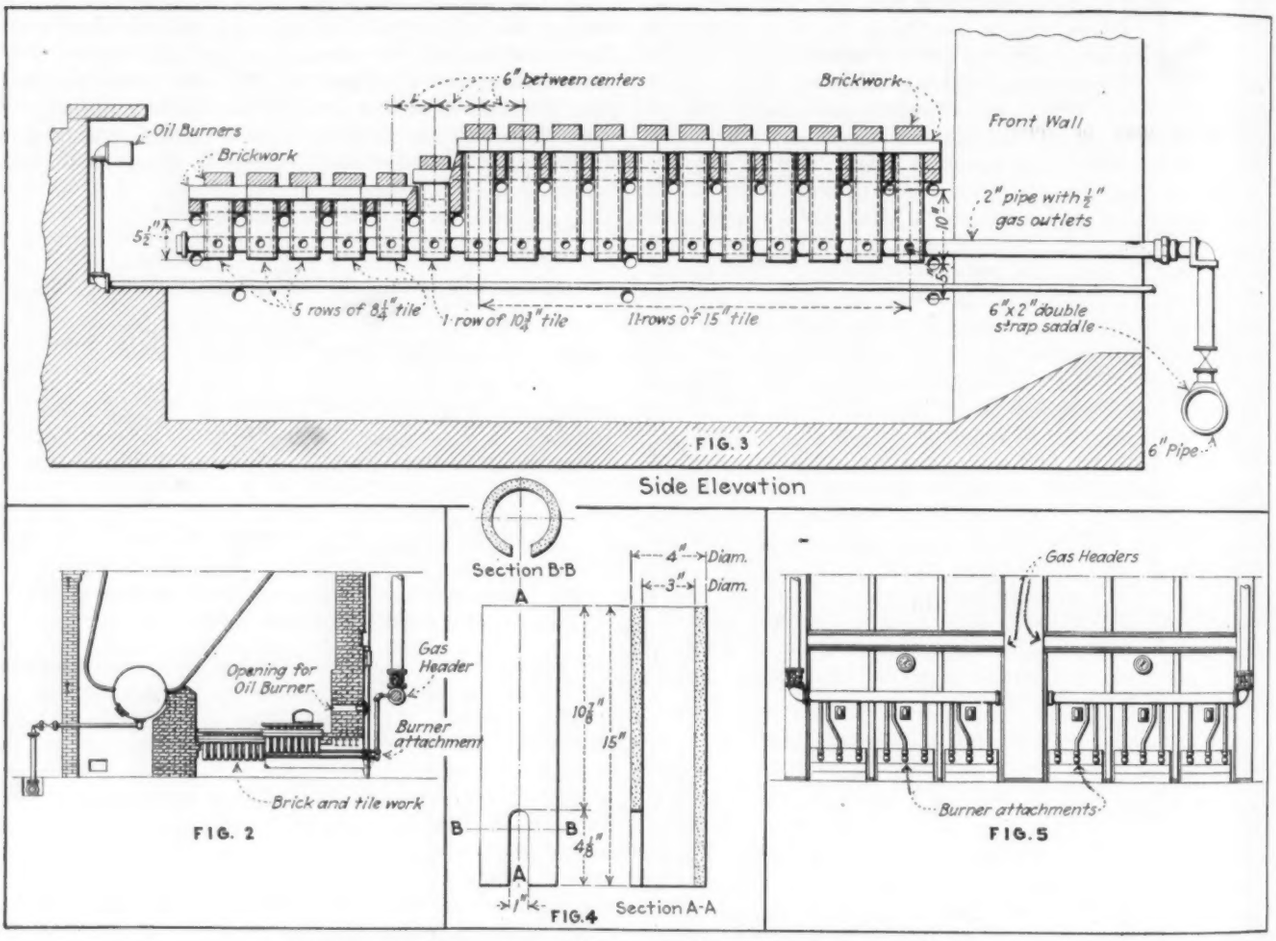
A Humian-Junkers constant-flow calorimeter is used to determine the B.t.u. value of the gas. In this type there is a constant flow of water through the calorimeter and the gas is burned at a constant rate. The temperature of the water at the inlet and outlet of the calorimeter is very accurately read from thermometers calibrated to 0.1 deg. F., mounted with telescopic sights. The gas burned is measured with a very accurate meter of the wet type, and corrections are made for barometer and gas pressure. With these corrected measurements the B.t.u. per cubic foot is the following calculation:

Temperature rise of water × weight of water ÷ cubic feet of gas used. *

The B.t.u. values of the gas are used as a basis for comparative efficiency data. The total B.t.u. of the gas consumed during a twenty-four-hour period is used to determine the B.t.u. per kilowatt-hour, or the over-all efficiency of the plant. Knowing the total B.t.u. value of the gas consumed, the equivalent barrels of 14-deg. Beaumé fuel oil may be calculated. From this the kilowatt-hours per barrel of oil is figured and used by the operators who are more familiar with the firing of oil to get some conception of the relative performance of oil and natural gas.

For accurately calculating the gas consumption as recorded by orifice meters, the specific gravity of the gas must be considered as this has a material bearing upon their accuracy. For this purpose an Edwards density balance is used.†

The specific gravity of the gas is the ratio of the total pressure required to balance the beam in air to that required to balance it in the gas. The specific gravity of the gas must be accurately determined, as a slight inaccuracy extending over a month's time will mean a large difference in the monthly fuel bill. The beam is brought to balance three times on gas and air, and the average of the three readings is taken as a



DETAILS OF BURNER SETTINGS FOR TYPICAL BOILER INSTALLATIONS

Fig. 2—Setting used with 800-hp. Connelly boiler. Two shutters control the air to the two sections of the combustion chamber. An emergency inlet is provided for oil burners. This is the present and most efficient application of gas burners under boilers.

Fig. 3—Burner setting in class M Stirling boilers. Used before present development was adopted. Oil burners were originally installed in an offset in the bridge wall.

Fig. 4—Cross-section of tile used.

Fig. 5—Front of 825-hp. Connelly boiler with main gas header and pipe feeds to each furnace. In burning gas it is essential that both the air and gas be easily and quickly controlled. In this plant the gas is controlled by the shifting of one lever so that the quantity of gas delivered to each boiler can be reduced immediately should the plant suddenly lose its load.

*There are other corrections which must be made also. One is for the relative humidity of the air. In general this correction is positive up to about 8 per cent humidity and negative for humidity above this amount, varying with the temperature of the air in the room. The other is for the difference in temperature, if any exists, between the room and the water at the inlet, due to the heat that may be absorbed or given off by the body of the calorimeter.

†This instrument consists of a balance beam carrying a sealed cylinder on one end and a counterweight on the other. The balance beam with its support is mounted in a gas-tight chamber, to which is attached a mercury manometer and a small rotary vacuum pump operated by a small motor. The balance case and manometer connections are filled through an inlet needle valve with dry air, and the pressure is adjusted by removing the excess air through another needle valve by use of the small vacuum pump until the beam balances, which balance is ascertained by the observation of the cross line on the end of the beam. After this pressure is determined the balance is evacuated by use of the vacuum pump and filled with gas. The pressure is again adjusted until the beam is in equilibrium, and note is made of the pressure.

basis from which to make calculations. The variations of these readings are very slight, and the use of any one set has been found to be sufficiently accurate for calculation.

IMPORTANCE OF GAS ANALYSIS

It must be borne in mind that the analysis of the gas is continually changing owing to the variable demand made upon the gas companies for their product and the consequent necessity of cutting in and out of service different wells, each of which produces a gas of different analysis. With gas from different wells it is possible to obtain a theoretical CO_2 percentage in the flue gas of from 8 to 13 per cent. All of the gas used at the company's plants contains CO_2 ranging from a fraction of 1 per cent to 6.6 per cent, the balance being methane and ethane with minute parts of illuminants. Thus it may be seen that caution is necessary when prescribing a percentage of CO_2 as a basis from which to work toward furnace efficiency. Any changes in the gas can be readily detected by the firing of the boilers. The static and differential pressures are recorded by the differential meters, and the temperature of the flowing gas is recorded. Averages for the twenty-four hours are taken of the above pressures and temperatures and with the specific gravity found from test, and, knowing the orifice constant, the cubic feet of gas is calculated. If the gas tests were not made daily, it might work an injustice to the gas company as well as the power company.‡

NEW BURNER DEVELOPED

The San Joaquin Light & Power Corporation first used natural gas under its boilers at the Bakersfield steam plant in 1911. The first burners installed were of various types. Experiments were made with different burners in an effort to find one which would burn gas economically and at the same time would stand up in service. It was found that patented metal burners were rapidly destroyed, and in an effort to overcome this difficulty the tile burner was developed. At first this was a crude affair as there was no control of the air passing through the tiles, the only control over the fire being by increasing or decreasing the quantity of gas and opening or closing the dampers in the stacks. This original burner gave a very high combustion and high efficiency, and attempts to increase its efficiency by adopting a method of controlling the air through the combustion chamber resulted in an even higher development.

From the accompanying illustrations it will be seen that all air entering the combustion chamber must pass through the burner tiles, and by having a long

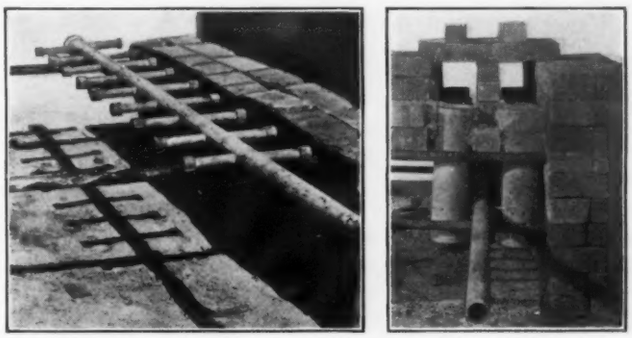
‡The following examples illustrate this point: The orifice constant for a 4½-in. orifice in an 8-in. line is 7004.5. Take the differential pressure as 32, static pressure as 21, gas temperature as 68 deg. F. and specific gravity as 0.65. The temperature gravity correction is 0.953; the pressure extension is 33.657; the cubic feet of gas per hour equals 7004.5 × 33.657 × 0.953 = 224,669. The cubic feet of gas for twenty-four hours equals 5,392,056. If the specific gravity had changed to 0.60 with the temperature, static and differential pressures the same as in the above example, the cubic feet of gas per twenty-four hours would be 5,612,736. If the gravity had been taken as in the first case, the plant would have used 220,680 cu.ft. of gas that did not show on the meter. As another case take the specific gravity at 0.70. Other things being equal, the cubic feet of gas per twenty-four hours would be 5,194,932. In this case if the specific gravity had been assumed to be 0.65 and the true gravity was 0.70, the plant would not have used 198,024 cu.ft. of gas that showed on the meter. From these examples the necessity of taking gas samples each day is evident. Assuming that the plant is carrying a load of 10,000 kw. and that the calorific value of the gas is 972 B.t.u. per cubic foot, then in the first of the examples the B.t.u. per kilowatt-hour equals 21,837, in the second 22,731 and in the third 21,035. From this it will be seen that the engineer cannot get a correct report of the number of B.t.u.'s per kilowatt-hour unless he absolutely knows the calorific value of the gas in question.

RESULTS OBTAINED WHEN BURNING GAS

(Based on weighted water tests run on an 825-hp. class M-30 Stirling boiler)

Boiler Rating (per Cent)	CO_2 in Flue Gas (per Cent)	Temperature of Flue Gas (Deg. F.)	Efficiency (per Cent)
84	9.88	443	84
110.6	10.5	518	84.7
139	9.8	578	82.7
163.64	10.64	514	82.2
171.2	9.3	625	78.3

tile with two baffle bricks over each one a high degree of oxidation is insured. A gas burner to be efficient and economical must have the heat applied properly in the combustion chamber. Gas burners of the horizontal type are likely to damage the boiler foundation and side and bridge walls of the boiler settings owing to an excessive heat being concentrated in certain spots in the combustion chamber. Some burners will not carry boilers at a high rating without causing excessive vibrations or pulsations which can assume dangerous proportions. These pulsations are due primarily



GAS-BURNER HEADER SUPPORTED BY PIPE AND RED BRICK PIERS AND DETAILS OF FURNACE CONSTRUCTION FOR GAS BURNING

Left—The header is very accurately drilled and tapped so all nipples will be in a horizontal plane. Orifices ¾ in. in diameter are drilled in the nipples to permit issuance of the gas. Right—The fire brick wall starts at the burner supports with two courses below the top of tile. Pipe or rod supports hold the tile or burner floor in place. The powdered asbestos cement and fireclay mixed half and half is also supported by the pipes. Asbestos and fireclay are packed around the tiles to allow expansion and reduce breakage. All air entering the combustion chamber passes through the tiles.

to improper mixing of the gas and air which gives incomplete combustion in the form of a series of explosions.

The San Joaquin burner does not have these objectionable features. The load on the boiler can be varied from 25 to 200 per cent boiler rating without back flares. This feature is due to the small gas orifice and the extreme length of the burner tile. Furthermore, the gas is distributed over the entire furnace floor and is not concentrated in the front or at the back of the furnace. The burner tiles are supported by ½-in. pipe nipples and are held in vertical position by shredded asbestos and high-heat-resisting fireclay, allowing perfect freedom for expansion of the tiles. The arrangement and number of burners required for any given installation depends on the width and depth of the combustion chamber and the horsepower of the boiler. Quality of the gas, except in extreme case of an excessive amount of water, has not made any change in the satisfactory operation of the burners which are now being used.

The assistance of C. P. Rhine, designing engineer, and R. A. Wallingford, boiler-room efficiency man, in the preparation of this article is acknowledged.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Importance of Cable Engineering

To the Editors of the ELECTRICAL WORLD:

I have been impressed many times recently with the lack of appreciation, on the part of young engineers as well as some old ones, of the magnitude and importance of cable engineering as a part of electrical engineering. In trying to find a reason for this, I am inclined to believe that there is at least some fault in the university training of these engineers. I think any one will agree, any analysis will show, that most of the emphasis of electrical engineering courses is on machinery, with some attention to high-voltage transmission, and that cable work is largely neglected.

I think it will surprise some to know that this company spends almost twice as much for lead-covered cable as it does for turbo-generators, and that the investment of this company in overhead and underground lines, including the poles and conduits and manholes, is nearly one-third of the total investment.

A superintendent of one of the large cable factories told me recently of his difficulty in finding a technical man who would devote his time to research work on wires and cables, principally lead-covered cable. In answer to an advertisement he said he had about twelve or fourteen applications, and when these men, who were all technical graduates, were told that the research was to be regarding lead-covered cable, they thought the field entirely too narrow and did not consider it worth their while to undertake such work. Where did the technical graduates get such ideas, and is it not fair to assume that their ideas regarding the narrowness of the field were due in large part to the fact that while they were in the university they received very little information along such lines and performed in the laboratory no experiments or tests on cables? Is it not true that the technical graduate forms his opinion of the relative importance of the various lines of engineering work largely from the amount of time devoted to the various subjects by the professors in their classwork and their lectures, and by the routine experiments or tests which are required of him in the electrical engineering laboratory? And if the technical colleges in their classwork and in their laboratory work devoted an amount of time to the subject of wires and cables in keeping with the importance of these subjects, do you not think that the condition above described would have been reversed, and would not the cable manufacturer probably have had more applications than he could use, instead of being turned down by fourteen men who answered his advertisement?

That particular manufacturer has no occasion for feeling lonesome. There are other manufacturers and utilities that are in exactly the same condition. As you are aware, there have been some tremendous advances in the art of cable manufacture in the past five years, and there is every reason to believe that the present rate of improvement will continue for some years.

The manufacturers that are making the most progress are the ones who have a staff of technical men continuously engaged on research work, and the ones that are making the slowest progress have no men whatever engaged continuously on research work, or perhaps do a little research spasmodically when they are forced into it by difficulties in meeting their guarantees. The last two sentences are not mere theories or ideas, but are statements based upon the records of our tests on cable purchases made in the last four years. We buy cable from all of the leading manufacturers in this country, and we are able to tell from the tests on the cables that we purchase just when a manufacturer makes an improvement in his product and the amount of the improvement. We can also tell from these records, beyond any doubt whatever, which manufacturer is in the lead, and, with a very close degree of accuracy, the relative standing of the leading makers in the art of cable manufacture. Their order shifts a little from time to time, owing to the varying amount of research work that is being undertaken by the several manufacturers.

In view of the facts set forth above, does it not seem self-evident that the regular series of tests offered to the higher students in electrical engineering laboratories should include a few tests on lead-covered cables? Such tests, for example, might be thermal resistivity of the insulation and dielectric loss. If the dielectric-loss curves are taken at a number of temperatures and voltages on a single piece of cable, then these curves will show the ionization loss in the cable. All of these tests could be made on a single piece of single-conductor cable, permanently set up in the laboratory, although it might be more convenient to have the two tests made on two separate pieces of cable. I think that these tests would very likely require the use of instruments and methods of tests which would be entirely different from any of the tests which students are now performing, and if this is the case would not such tests be a distinct addition to the laboratory? And would not the laboratory, with the addition of these tests, give students a better idea of the relative importance of the various branches of electrical engineering than they can possibly get without such equipment?

D. W. ROPER,
Chairman Joint Cable Research Committee of A. I. E. E. and N. E. L. A.
Commonwealth Edison Company,
Chicago, Ill.

Lighting of Hampden County Memorial Bridge at Springfield, Mass.

To the Editors of the ELECTRICAL WORLD:

Referring to page 378 of the Feb. 17 issue of the ELECTRICAL WORLD, showing a night photo of the Hampden County Memorial Bridge at Springfield, Mass., which was taken by the writer, I would call your attention to an error which occurred in the description of the lighting.

Your account makes it appear that one 500-watt "Mazda C" lamp was used in each of the four 80-ft. towers in a globe of 2½ ft. diameter. These towers each use four 500-watt "Mazda C" lamps, which are inclosed in a sectional diffusing globe 6 ft. in diameter. Owing to the height of the towers and the characteristic of the globe it was necessary to use approximately five times the wattage in this unit that was used in the ornamental luminous-arc lamps to obtain the correct balance in the lighting effect.

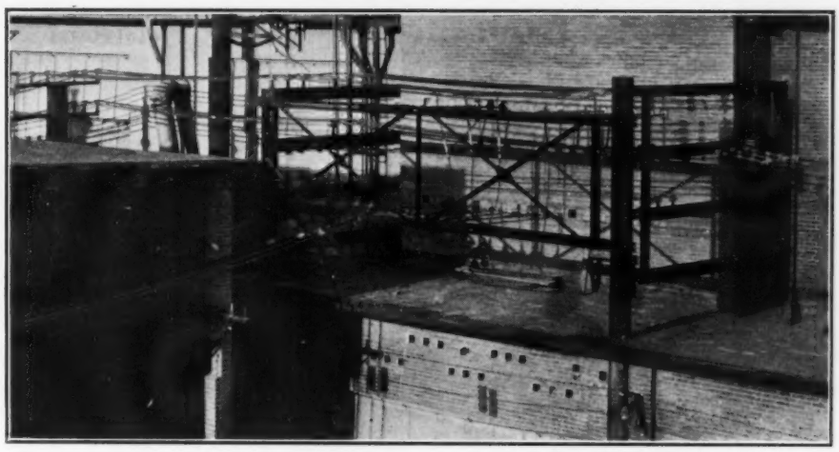
L. O. INGALLS,
Electrical Engineer.
United Electric Light Company,
Springfield, Mass.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of
Generation and Distribution Equipment, and Methods of Economically Utilizing
Electric Service in Large Industrial Plants

Cable Rack for Industrial Power House

EXIGENCIES often arise in industrial-plant layouts which involve extensive and difficult changes in electric power distribution facilities, and too often, it sometimes seems, a pipe line or some structural arrangements force the power distribution system out of its logical and important position in the industrial-plant plans. No doubt this condition has arisen because of the inherent flexibility of electric distribution systems as compared with the carriers of other forms of energy.

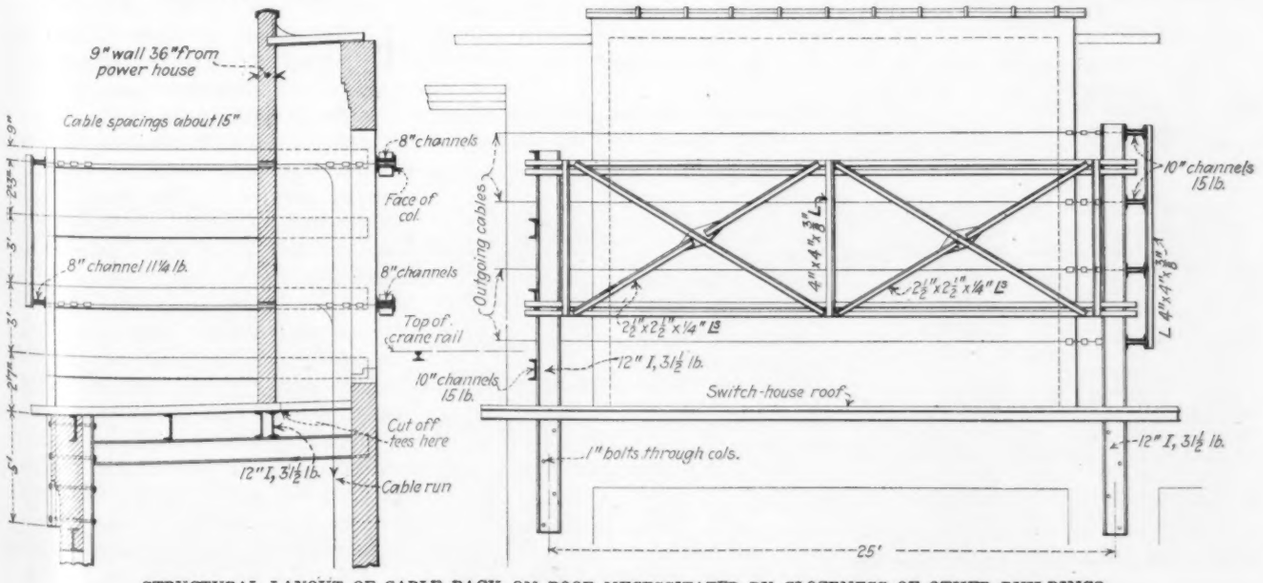


CABLE RACK CONVENIENTLY BUILT ON SWITCH-HOUSE ROOF

Some time ago a problem presented itself during the construction of a large industrial plant concerning the arrangement of outgoing power feeders from the power house. The original design contemplated the feeders leaving the switch house at right angles to the outer wall, but subsequent location of additional buildings adjacent to the power house left only one avenue for the power feeders—parallel with and above the switch house, which was essentially a lean-to structure half the height of the power house.

Naturally a cable rack above the roof then became essential, but running the leads from the interior of the switch house to the rack above presented considerable difficulty. It was not possible to obtain room for an exit on the outer wall of the switch house owing to adjacent structures, and roof bushings are not often desirable for the usual industrial-plant conditions. A solution was found by building a 9-in. "false" wall from the roof of the switch house about 36 in. out from the power-house wall. The roof purlins of the switch house under this wall were reinforced by a 12-in., 31½-lb. I beam. A large steel-frame window in the power-house wall was removed, permitting the placing of channel members as shown in the line drawing to carry the ends of the short transverse cables. The cables from the switching equipment were run vertically along the wall and were spliced to the transverse cables. A short vertical jumper connected the transverse cables with the line cables above and below the transverse cables and running parallel to the walls of the power house.

All dead-end connections were made without the necessity of drilling by arranging 8-in., 11½-lb. chan-



STRUCTURAL LAYOUT OF CABLE RACK ON ROOF NECESSITATED BY CLOSENESS OF OTHER BUILDINGS

nels back to back with spacers so that a space of 1¼ in. was left between them in order that any size of eyebolt required might be inserted in the slot. At one end of the rack 10-in. channels were provided for attaching steel pins and line insulators.

The transverse cables are horizontal, but water does not run in through the wall bushings as the very slight sag in the cables causes a drip to be formed on the cables outside the false wall 36 in. from power house.

J. E. HOUSLEY,
Electrical Engineer.
Aluminum Ore Company,
East St. Louis, Ill.

Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Dangers from High or Low Water in Boilers

VERY serious damage may be caused in boilers or to engines or turbines connected to them if the water becomes too high, so that it goes over into the steam main, or if it is too low, causing the boiler to overheat. There are three things that may cause the water level to rise quickly, and that should be very closely watched by the water tender: (1) Increasing the forced draft, particularly when the setting and the water in the boiler are still hot from previous high steaming rates; (2) increase in feed-water pressure, caused by placing an additional feed pump in service or by decrease of feed-water temperature; (3) faulty action of the feed-water regulator.

In case of high water the following preventive steps abstracted from the operating code of the Philadelphia Electric Company should be taken as a typical method for reducing the water level properly:

INSTRUCTIONS TO REDUCE HIGH WATER IN BOILERS

1. Close the feed-water valve.
2. Try the gage cocks to make sure that the water is high.
3. Open the superheater drains and surface blow-off valves, if easily accessible.
4. Cut off the forced draft.
5. Open the blow-off valves.
6. Stop the stoker.
7. Partly close the back damper, leaving sufficient draft to clear the gases.
8. Maintain practically a banked condition and blow down until the water level has been lowered to between two and three gages.
9. If a feed-water regulator is in service, close the feed valve to the regulator and operate the feed valve by hand until the trouble has been located.
10. When normal water level is reached put the boiler in service.

Low water in a boiler may be dealt with under two divisions—one treating conditions where the water in the gage glass is low and can be seen and the other where the water is below the gage glass.

Case 1. When the water level in the gage glass is low it should be brought to normal level by increase in rate of feeding the water.

Case 2. When the water is out of sight and the water tender has no positive knowledge of its level a very dangerous condition exists which may result directly in a disastrous accident, or later in extended and expensive boiler repairs, unless proper steps are taken to remedy this condition at once.

Should water be admitted to overheated drums or tubes, the sudden formation of steam would greatly increase the pressure, which would violently rupture the boiler metal in case it was hot enough to have lost its strength. The least that can be expected would be loosening of the tubes in the drums or headers, caused by the uneven contraction of the boiler metal when the cold water touched the hot surfaces. In this case the fire should be dumped and the boiler subjected to a hydrostatic test. The specific instructions for this operation follow:

WHEN WATER IS BELOW GAGE GLASS TAKE BOILER OUT OF SERVICE

1. Close the feed-water valve to the boiler.
2. Cut off the forced draft.
3. Partly close back damper, leaving sufficient draft to clear the gases.
4. Stop the stokers.
5. Where possible, drop the dump plates.
6. Drown the fire and allow the boiler to cool.
7. As the steam pressure drops, shut the main stop valve.
8. Close the trap-line valve above the automatic non-return valve.
9. Lock the automatic non-return valve.
10. After the boiler is cool, open all vents between automatic non-return valve and the boiler.
11. Inspect the boiler and subject it to a hydrostatic test.

Induction Motor-Generator with Compensator Start

INDUCTION motors of motor-generator sets without slip rings and external secondary resistance must be protected against excessive starting current by impressing a low voltage on the primary in starting. This voltage is obtained by placing the compensator handle in the starting position. When the machine has reached approximately full speed full voltage is impressed by throwing the compensator handle to the running position. The following abstracted from the operating code of the Philadelphia Electric Company are instructions for operating these sets:

STARTING

1. Close the alternating-current bus switch.
2. Place the compensator in the starting position.
3. When the machine comes up to speed place the compensator in the running position.
4. Close the generator field switch.
5. If the generator is compound wound, close the equalizer switch.
6. Adjust the direct-current voltage to that of the bus and close the circuit breakers and negative and positive machine switches.

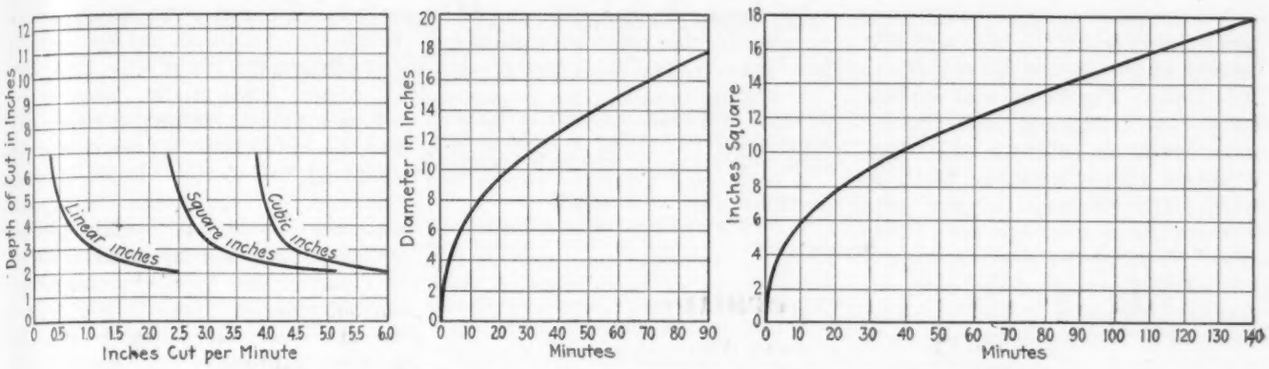
SHUTTING DOWN

1. Reduce the load of the machine to be taken off to as low a value as possible.
2. Trip the direct-current circuit breakers and open the machine and equalizer switches.
3. Open the alternating-current bus switch.
4. Return the operating handle of the compensator to the "off" position if it does not return automatically.

Repairing Flume Without Interrupting Service

FIVE miles of wood flume supported directly on the ground along level stretches and on wood trestles at gulleys is being rehabilitated by the Tennessee Electric Power Company without taking it out of service. The flume, which serves the 15,000-kva. hydro-electric station No. 2 on the Ocoee River, measures 11 ft. x 14 ft. in cross-section and carries 13,000 cu.ft. of water per second. The wood bents supporting the bottoms and sides are being replaced by galvanized-steel bents and the wooden trestle by concrete. The substitute parts are being placed between those to be replaced so that the latter can be removed as the work progresses. Seven hundred out of 6,400 bents have been installed.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.



RATE OF CUTTING CAST-IRON PLATES (LEFT), CIRCULAR SECTIONS OF CAST IRON (CENTER) AND SQUARE BLOCKS OF CAST IRON (RIGHT)

Cutting Metals with the Electric Arc

THE process of arc cutting is purely a melting process, the heat energy of the arc terminal being directed along the line where the cut is desired. Graphite or carbon electrodes are usually employed for this work. In special cases metallic electrodes heavily wrapped with asbestos yarn employing current values higher than normal have been used for cutting, the electrodes being first dipped in water, which forms steam and blows the molten metal away. This method, however, is quite expensive and has been used only to a limited extent by the British Admiralty for cutting deep, small diameter holes in armor plate.

For general cutting work graphite or carbon electrodes are used and current values of 300 amp. to 1,000 amp., depending upon the nature of the work and the cutting speed desired.

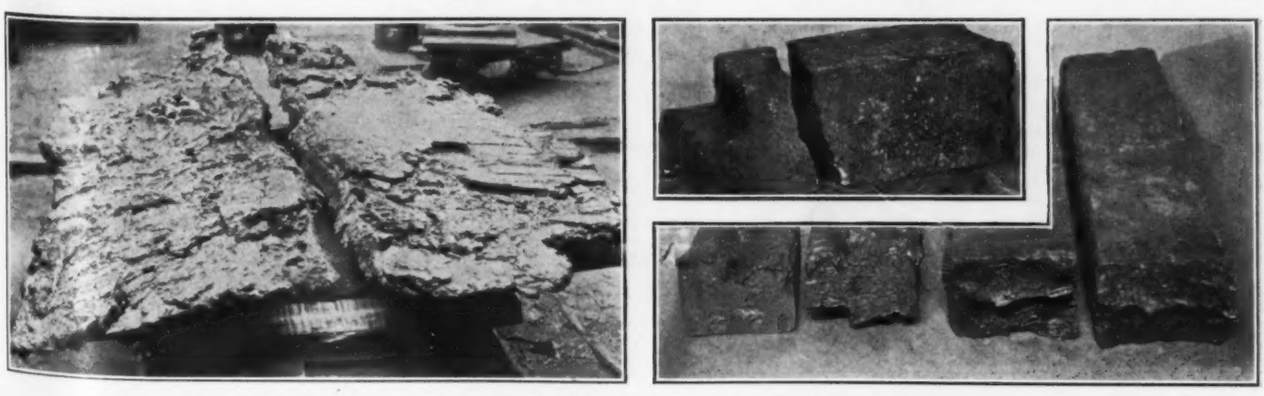
Foundries make use of arc-welding equipment for repairing defective castings and use the same apparatus for cutting off risers and burns from their castings. A riser from a large gray-iron casting was cut through the neck in five minutes' time, using 800 amp., the neck measuring 3 in. x 9 in. The riser was then cut through the main portion, 8 in. x 8 in., in seventeen minutes, using the same current. With labor at 60 cents an hour and electric power at 2 cents a kilowatt-hour for the motor-generator, there would be a cost of 15 cents for cutting the neck and 52 cents for cutting the body of the riser. The speed of cutting castings of several forms is shown in the accompanying curves, using a current of about 600 amp.

Where it is desirable to cut the material to accurate dimensions, it is necessary to lay out a guide line with white lumber crayon which the operator can follow with his arc. It is then possible to make a neat cut in plate steel ¼, ⅜ or ½ in. thick. As an example, a piece of ¼-in. plate steel was cut at the rate of 75 ft. per hour, using 450 amp.

Companies will find the arc process by far the cheapest method for cutting rivets and for cutting up steel-plate material into pieces sufficiently small either to be charged directly into the cupola or to be cut up to such size that the pieces may be handled for recutting in a shear. The plate material in these cases is generally heavily covered with paint or rust so that current values of 400 amp. to 600 amp. are frequently used, and in some instances as much as 800 amp. Using this latter current value coal cars have been cut up at an average rate of 75 ft. per hour, an entire coal car being cut up in four hours' time into pieces sufficiently small to be handled by four men who were shearing the material for cutting into charging size. The cost, including labor and power for the motor-generator, was $6.80.

For cutting the rivets, currents of 400 amp. or 600 amp. are usually used. When using 400 amp., average operators will cut from 1,800 to 2,000 rivets, ⅞ in. in diameter, per ten-hour day, and some operators will run as high as 2,600 to 3,100 such rivets when the work is on a piece-rate basis. Cutting with the arc is not limited to iron and steel, but can be applied equally well to non-ferrous metals such as brass, bronze and copper. In fact for cutting copper which cannot be cut mechanically the arc process is by far the cheapest to use.

Because of the high thermal capacity and high heat conductivity of copper it is necessary to concentrate the applied heat at a sufficiently high rate to melt the copper before the heat is dissipated in it. To do this cutting effectively it has been found most satisfactory to use a current value of 800 amp. to 1,000 amp.



ELECTRIC ARC EFFICIENTLY CUTS COPPER SLAG (LEFT), IRON CASTINGS (CENTER) AND COPPER BILLETS (RIGHT)

A large piece of copper slag which was originally 6½ ft. wide and 7 ft. long along the central cut had several cuts made. The metal was approximately 1½ in. thick through the sections where the side cuts were made. This was done at a rate of 3½ ft. per hour. The thickness of the metal through the central cut varied from about 1½ in. at the extreme edge to 7 in. at the center of the piece, the average thickness therefore being about 4¼ in. This cut was completed in five hours. A current value of 1,000 amp. was used for all this work The cost on the basis of labor at 60 cents an hour and electric power for the motor-generator at 3 cents a kilowatt-hour is $16.78.

A. M. CANDY,
General Engineering Department.
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Safety Entrance Switches with Meter Adapters

INCLOSING service entrances and meter loops has received much consideration during the past year, and many companies which formerly had no specified entrance requirements have adopted some type of combination safety entrance box. The benefits derived from this type of entrance are evident. They include a decrease in fire hazard over open meter loops, the prevention of tampering with the meter as all wires are inclosed and sealed between service brackets and meters, and the improved and more uniform appearance of the meter installations. Companies which have adopted certain types of switches have had minor problems to solve arising from the peculiarities of the type of switch, while others are attempting to solve the same problems before announcing their requirements.

The following questions no doubt have confronted many companies and have led to varied solutions:

1. Will the extensive use of entrance switches and keen competition between manufacturers develop a more practicable switch than is now on the market?
2. Is it good policy to specify one particular type of switch?
3. If a particular make of switch is not specified, will meter installations become a hopeless assortment of different types of boxes, causing much trouble and expense in changing meters and testing and also resulting in the electrical contractors using the cheapest box procurable?
4. Which should furnish the meter adapter, the central station or the consumer?
5. Are testing devices essential, and, if so, who should bear the expense?
6. Should the box be so constructed as to permit the renewal of blown service fuses by the customer without breaking the seal on the box?
7. Has the company a legal right to seal a switch box owned by the consumer?
8. If the service fuses are sealed: (a) Shall the consumer be required to place an additional set of fuses on the load side of the meter, when there is only one circuit in the house? (b) Should the customer or any electrician have permission to break the company's seal to renew service fuses? (c) Who should bear the expense of renewing the service fuses?
9. If the service fuses are accessible to the customer: (a) Will a fire hazard often be created by improper fusing or cutting out of fuses when none are available at the time of blowing? (b) Will the assurance against theft of energy be decreased?
10. What type of fuses shall be specified for the service, plug or N. E. C. standard?
11. Will older types of meters have to be junked for lack of suitable adapters for them?
12. Should the combination entrance box be required on previously wired installations when these are reconnected?
13. Does the expense to both consumer and central station justify the requirement of this type of entrance?

In adopting a standard entrance box it is essential that the box be rugged in construction, simple in operation, plainly designating the "off" and "on" positions of the switch, equipped with some device which will facilitate testing without removing wires from the load side of meter, and at the same time afford means of supplying electricity to the premises by conveniently shunting the meter. If more than one box is approved, the meter adapters should be interchangeable, or else difficulty will be encountered in changing the type of meter at an installation where the type of box is not the same. It will also cause an undue investment on account of having to carry in stock an assortment of adapters for each box.

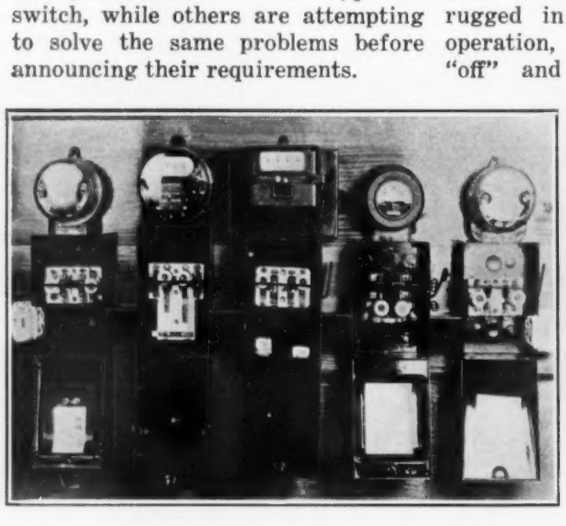
It seems plausible that sooner or later some standard specifications in the manufacture of these boxes must be adhered to, and it is up to the central stations to specify this standard and avoid the use of the irregular designs before their lines are crowded with boxes which will eventually be objectionable. A good combination box is an asset to both the consumer and the central station, but a poorly made and designed meter entrance box is far worse than none at all.

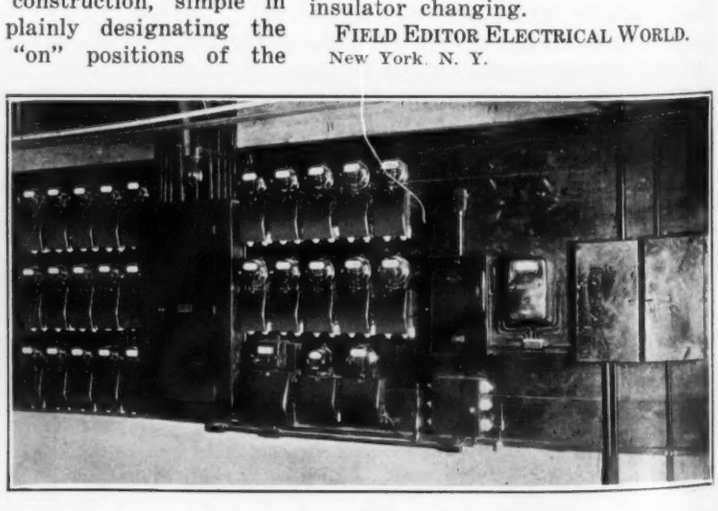
W. C. DEVIN,
Meter Department.
Chester Valley Electric Company, Coatesville, Pa.

Repainting Towers with Conductors Alive

OWING to the fact that the Tennessee Electric Power Company has no loops or duplicate circuits in most parts of its system, it is repainting its black-steel towers while the circuits are "alive." Around the conductors and in the other hazardous portions of the tower this is being accomplished by using paint brushes attached to insulating wood poles like those used in live-line insulator changing.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.





METER ENTRANCE BOXES MUST BE RUGGED AND PROVIDE SUITABLE MEANS FOR SHUNTING AND TESTING

The Stoker Problem Discussed from an Operating Viewpoint*

THE mechanical stoker regarded as a unit is one of the most reliable pieces of apparatus in station equipment provided that it is worked continuously and is operated and maintained intelligently. This statement is qualified because it is felt that there is room for improvement in design to provide against undue depreciation of the stoker while in a banked condition and to insure that it is not put out of commission during the banked period or while bringing it from "banked" to "steaming."

With regard to the subject of maintenance, there is still a chance for further improvement. Particular reference is made to those parts on the stoker where the wear is greatest, emphasizing that the construction be made so that these parts can be renewed separately.

In discussing the efficiency of the stoker the auxiliaries which the stoker imposes are also included. If inefficient auxiliaries are required, then the use of them must be charged up against the stoker.

Factors Controlling Efficiency of Stokers

In using the stoker efficiently the operator is bound by limitations of design over which he has no control. He has a definite load to maintain, and if this is maintained efficiently, a definite amount of coal is required. The size and distribution of the air holes in the grates and the grate area are fixed quantities for the operator. These two items should be so accounted for in the design that, for continuous operation at uniform rates, a fuel bed can be maintained of such shape and thickness that the proper amount of air will pass for the efficient burning of the coal and that the coal will approach 100 per cent combustion before reaching the grinder pit.

It is realized that the designer cannot design the furnace to meet uniform conditions of service and at the same time produce a furnace for wide and rapid change in the rate of forcing without some sacrifice of efficiency. However, the design should be such that the change can be made without undue throwing of the coal by the air, so that the contour of the fuel bed may be brought back to give efficient operation.

It is generally conceded now that it is not feasible to operate the clinker-removal system continuously in synchronism with the stoker drive but that it is better to adopt a policy of intermittent operation in order to allow for variations of ash content in the coal and for the different rates of forcing the stoker. There is one objection to this method of operation: As the grinder always removes the refuse faster than it is made, the responsibility for keeping the clinker grinder from burning out is left to the operator. Hence it has been found desirable to speed the grinder up to a point where it is only necessary to operate it a few minutes out of each hour.

Design of Clinker Crushers Claimed to Be Wrong

A fallacy in design that has done more to discredit the clinker grinder than any one other thing is the usual shape of the grinder pit. When the coal reaches the clinker pit it is nearly all ash, and there is then very little decrease in volume. However, almost invariably the clinker pits are designed with decreasing volume as the ash proceeds on its way. This particular mistake in design is causing a large part of the trouble met with today with clinker grinders.

While discussing the coal feed, it should be pointed out that the same mistake is made as in the grinder pit. Why decrease the size of the hopper as the coal feeds down closer to the ram? Agitation would be needed in few cases if the hopper were properly designed.

If the variable forced-draft fan does not prove possible, other things considered, then a compromise ought to be made by running several fans to a common duct serving several boilers and by arranging to take fans out of operation in order to maintain the desired conditions. By following this method the efficiency will be impaired only when the pressure is not carried at an economical point for the given speed. The delivery of air per fan can be maintained approximately constant and therefore efficiently.

The cost of operation of stokers is affected both by the design and by the method of operation. The admission of air through the brickwork of the side walls and side air boxes has done much to cut down cost of operation as well as maintenance owing to absence of clinkers. The increasing amount of air added above the fire, however, will have to be taken into consideration in the design of the stoker when its use is extended to other parts of the furnace, as is the tendency in new layouts.

The designer of the stoker should do everything that is possible to reduce siftings. The accumulation of siftings not only increases operating cost because of the labor of removing but also by the moral effect on men working in untidy surroundings.

With the improved method of operation and the improvements in the design of the stoker that have been made, the labor of operation has been reduced to a minimum, and today 60,000 kw. is being produced with three men, two of these being rated as water tenders and stoker operators and the other as greaser and oiler and general utility man. The stoker has been brought today to a degree of perfection where there is no advantage from the labor standpoint in burning oil.

Heating Feed Water by Bleeding Main Turbine Units

Perhaps it would not be out of place to speculate on changes in stoker design which will have to be made in the future in order to keep pace with changes of methods in other parts of the plant. The particular thought in mind is the change of sentiment with regard to the source of heat for feed water. The latest ideas on the subject among engineers who have made a study of this problem is to bleed heat from one or more of the stages of the main turbine in addition to what may be obtained from steam auxiliaries and house-turbine sets.

This method is making the installation of economizers harder to justify in large power plants. The heat from the flue gases, however, cannot be wasted; therefore preheaters will be forced into use, and apparatus for this purpose, which is now effectively in use abroad, will undoubtedly be introduced into this country. When this becomes an accomplished fact and air is being delivered to the boiler at 200 deg. or 300 deg. F., there will be need for redesigning grate air-flow passages to meet the new requirements in order to maintain the present good results in maintenance.

R. E. DILLON,
Assistant Superintendent
Generating Department.
Edison Electric Illuminating Company,
Boston, Mass.

*Extract from an address before the Stoker Manufacturers' Association.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Hazards of Amateur Radio Antenna

THE sub-committee on radio of the accident prevention committee of the National Electric Light Association, has recently reported on twelve fatal accidents caused by radio enthusiasts coming into contact with light and power circuits when installing aërials or working with radio conductors. The committee calls attention to installations being made by youngsters and laymen which were heretofore made only by experienced linemen.

A serious aspect of the situation is the fact that the accidents are due entirely to ignorance and are of a character which regulation cannot reach because the damage is done before the authorities who must administer regulatory measures are aware of what is going on. Court penalties are therefore ineffective. The committee has called attention to some of the educational work done by central stations in sending out bill stickers and by the use of newspaper advertising, talks to school children and in some cases warnings and information broadcast over the radiophone itself. The following points have been compiled by the committee from data used by a number of companies in such educational work:

Never pick up a wire lying on the ground or dangling from a pole. The wire might be alive, that is, charged with electricity to a dangerous degree. Report fallen wires immediately to the police department or power company.

Never climb a pole to which wires are attached. They might be in contact with high-voltage wires and consequently dangerous.

Never string wireless aërials over or under any other wires. Should these two sets of wires come in contact with each other, the aërials might become dangerously charged.

Never attach radio aërials or anything else to poles carrying wires of any sort. Accidental contact with live wires may cause injury or death or bring about fires.

Always attach aërials to substantial supports so located that if either the support or aërial wire breaks it cannot come in contact with other wires.

Remember that it is quite practical to operate a radio set with an indoor aërial.

Do not use kite aërials.

Do not attach antennas to chimneys. Chimneys were not designed for such purposes, and you might be down below when the bricks start falling.

In the interest of public safety the company is forced to forbid the attaching of any radio aërials to its poles and to insist that no radio antennas be strung above its power distribution wires.

The committee also made the general recommendations that amateurs should not be allowed to attach aërials to poles or towers carrying electric light or power wires and that surveys should be made and aërials in hazardous locations, insecurely fastened or supported, should be condemned or removed. The central-station companies should co-operate with those installing aërials and when practicable supervise their erection. Indoor aërials are recommended where practicable, and care should be taken to see that storage-battery and rectifier sets are properly installed as to both electrical and fire hazards. It was also recommended that reliable information as to radio hazards and prevention methods should be given adequate publicity. This information should be widely distributed through newspaper men, superintendents of schools, and to the general public by talks, newspaper advertising, stickers on customers' bills and other available means.

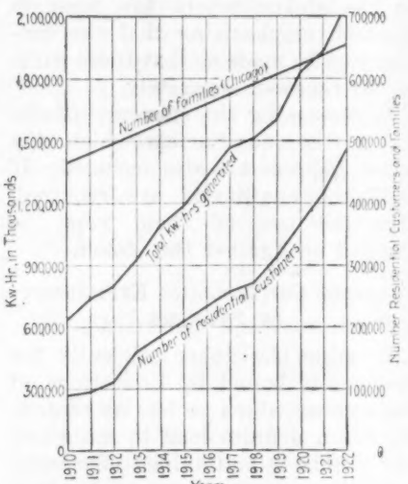
Boston Edison Forming Boys' Club

TO INTEREST boys of ten to sixteen years who are related to its employees, the Edison Electric Illuminating Company of Boston is forming an "Edison Light Boys' Booster Club," under the direction of L. D. Gibbs, superintendent of the advertising department. A letter has been sent to all of the company's employees with the object of ascertaining the probable field of activity to bring the rising generation into closer contact with the business of producing and supplying electricity. It is expected to develop a self-governing organization and to include visits to plants and other "doings" of interest to boys in the company "family."

Twelve Years' Growth of Electric Service

THE accompanying diagram shows graphically how the number of residential customers on the lines of the Commonwealth Edison Company in Chicago has increased during the last twelve years. This increase has been much more rapid than the increase in the number of new families in the city.

Since 1910 the number of families



INCREASES IN CUSTOMERS, NUMBER OF FAMILIES AND KILOWATT-HOUR SALES

has increased less than one-half, while the number of residential customers of the Edison company has increased over four times. The chart shows that the territory is far from the saturation point as there are still about 157,000 families in Chicago who are not now being supplied with electricity. This fact provides a large field for expansion of the company's business.

In addition, commercial and large industrial users of electricity are constantly being added as customers. One of the greatest factors in increased business of the company, as reflected in the curve showing kilowatt-hour sales, is the increased use of electricity by the existing customers. The home is rapidly becoming electrified, greatly relieving the housewife of physical labors, and electricity is being put to more widely diversified uses as respects both power and light.

Installment Bonds Used to Finance Rural Lines

AN INTERESTING method of financing rural extensions is used by the Wisconsin Hydro-Electric Company at Amery, Wis. A separately formed construction company builds the lines, for which it receives payment from the central station in installment bonds having a face value of $500 each payable in twenty-five annual installments of $20 each. The annual payments cover both principal and interest.

The construction company has the privilege of selling the bonds to prospective customers on a rural-service line at $300 each. The plan is to sell a sufficient number of bonds to cover the entire expense of the extension for any given group of consumers. The $200 in addition to the purchase price covers the item of interest over the period of twenty-five years. The actual working out of the payment plan is shown in the accompanying table. Column 1 shows the bondholder's investment year by year as the installments are paid. Column 2 is the interest on the actual investment each year at 5.13 per cent. Columns 3 and 4 show the payments made yearly on principal and interest and make up the $20 yearly installment payment shown in the last column.

The contract with a prospective consumer is made contingent upon the ability of the Wisconsin Hydro-Electric Company to make similar contracts with a sufficient number of consumers to justify the extension from a revenue standpoint. The customer agrees to take service for a period of five years at rates that may now or hereafter be established as reasonable by the Wisconsin Commission. Following is the form of contract used:

CUSTOMER'S INVESTMENT IN INSTALLMENT BONDS WITH COMPUTED INTEREST RATE AND YEARLY PAYMENTS ON PRINCIPAL AND INTEREST

Year	Customer's Investment	Return at 5.13 per Cent	Annual Installment Payment on Investment	Interest	Total Annual Payment
1st	$300.00	$15.39	$12.00	$8.00	$20.00
2nd	288.00	14.77	12.00	8.00	20.00
3rd	276.00	14.15	12.00	8.00	20.00
4th	264.00	13.54	12.00	8.00	20.00
5th	252.00	12.92	12.00	8.00	20.00
6th	240.00	12.31	12.00	8.00	20.00
7th	228.00	11.69	12.00	8.00	20.00
8th	216.00	11.08	12.00	8.00	20.00
9th	204.00	10.46	12.00	8.00	20.00
10th	192.00	9.85	12.00	8.00	20.00
11th	180.00	9.23	12.00	8.00	20.00
12th	168.00	8.61	12.00	8.00	20.00
13th	156.00	8.00	12.00	8.00	20.00
14th	144.00	7.38	12.00	8.00	20.00
15th	132.00	6.77	12.00	8.00	20.00
16th	120.00	6.15	12.00	8.00	20.00
17th	108.00	5.54	12.00	8.00	20.00
18th	96.00	4.92	12.00	8.00	20.00
19th	84.00	4.31	12.00	8.00	20.00
20th	72.00	3.69	12.00	8.00	20.00
21st	60.00	3.08	12.00	8.00	20.00
22nd	48.00	2.46	12.00	8.00	20.00
23rd	36.00	1.85	12.00	8.00	20.00
24th	24.00	1.23	12.00	8.00	20.00
25th	12.00	.62	12.00	8.00	20.00
		$200.00	$300.00	$200.00	$500.00

APPLICATION AND AGREEMENT FOR RURAL ELECTRIC SERVICE

Whereas the undersigned,..... hereinafter called "the customer," desires to obtain electric service for use on..... farm, located on the.....side of the highway and on the.....of Section ....., Township.....North, Range .....West, in.....County, Wisconsin, and

Whereas the Wisconsin Hydro-Electric Company of Amery, Wisconsin, hereinafter called "the company," is engaged in the business of generating, transmitting, and supplying electric energy to the public for general use, and is contemplating the extension of service in Barron and adjoining counties, and

Whereas the Amery Construction and Supply Company of Amery, Wisconsin, hereinafter called "the construction company," is in the business of constructing and contracting, and desires to obtain a contract from the company to construct the said proposed extensions, and the company has proposed to the construction company, to employ it to construct said extension and to pay it in installment bonds of the said company for the total sum of principal and interest of five hundred dollars each, payable in twenty-five annual installments of twenty dollars each, beginning on the first day of January, 1923, and thereafter annually, until paid, said annual installments to be in lieu of both principal and interest with the privilege of said construction company selling said bonds to prospective customers along said extension, for the sum of three hundred dollars each, and soliciting contracts similar to these presents, and

Whereas the customer subscribing hereto firmly believes that there are many others along the highway leading from the company's high-tension electric system at..... .....of Section....., Township..... ....North, Range.....West, past the customer's farm and to..... in the County of....., Wisconsin, who are also desirous of obtaining electric service, and who will sign a contract similar to these presents, in the aggregate to warrant the construction of such extension and to insure a reasonable return to the company on its investment, the customer therefore hereby authorizes the company to proceed with the construction of an electric extension that will supply.....with single-phase, alternating-current electric service, at 115 and 230 volts, 60 cycles, delivered to and connected with the customer's nearest building on the premises above described, nearest to the company's transmission line; as soon as, in its judgment, sufficient applications and agreements similar to these presents have been obtained to warrant the construction thereof, and to insure the company a reasonable return upon its investment, it being understood that unless such sufficient agreements are obtained within one year from date hereof, then this contract shall be void; it being further understood that all cost of furnishing and constructing the transmission line along the highway and the branch line from the highway to the customer's nearest building and including transformer, lightning arresters, meters and all other equipment up to the meter, are to be paid for and thereafter to be maintained by the company so long as the customer desires service; all wiring beyond the company's physical connection to the customer's nearest building is to be provided by the customer at.....expense.

In consideration of the construction company and the company soliciting and being able to obtain a sufficient number of applications and agreements, in the company's judgment, to warrant it in constructing the electric extension applied for, and in consideration of the construction company entering into a contract with the company to construct the said extension, and to accept in payment thereof the bonds of the company above mentioned, the customer hereby agrees to take over and purchase from the construction company..... .....of said installment bonds in the sum of principal and interest of five hundred dollars each, and to pay the construction company for the same the sum of three hundred dollars for each of said five hundred dollar bonds, one of said bonds to be accepted and paid for when the poles for said extension have been distributed out as far as the customer's premises; and an additional.....of said bonds to be accepted and paid for upon the completion of said line and when it is energized for use of the customer.

In consideration of the premises, and of the company constructing the lines applied for, the customer hereby further agrees to give the company free use of right-of-way across any of his lands along the route taken for said electric line and extensions, together with permission to trim any trees, so that they will clear the wires and equipment of the company at least fifteen feet, on any property owned by.....

The customer,.....successors, heirs, or assigns, further agree to take and pay the company for electric service for a period of at least five years beginning not later than sixty days from the time said lines are energized by the company at such reasonable rates and charges for rural service and energy as are now, or may hereafter be, established by the Railroad Commission of Wisconsin.

It is understood and agreed by the customer, and also by the company and the construction company, that this application and agreement, when duly signed by them, is a binding agreement, and in the event that sufficient similar agreements are obtained within one year to warrant the company, in its judgment, to make said extension, this agreement shall not be subject to cancellation or revocation.

An Unbiased Criticism of Municipal Ownership

SELDOM is it possible to find an expression concerning municipal ownership which is not tinctured by the prejudices of one side or the other. For that reason an editorial, "The Power-Plant Issue," appearing in the Aberdeen (Wash.) *Daily World* of Feb. 15 is particularly refreshing. It deals with the taxation on the income of the municipal plants in Seattle and Tacoma for service which they propose to render by extending their lines beyond the corporate limits of those cities. In an impartial manner the editorial questions the efficiency of municipal operation and points out the unfairness of competition between the tax-exempt plant and the privately owned company. It further emphasizes the fact that after all the public pays the freight, for it must make up, through increased taxation, the loss sustained by the removal of city-owned property from the tax rolls. The editorial reads:

Seattle and Tacoma, in both of which the power plants are municipally owned, desire to sell power outside their city limits. The Legislature, so far as present proceedings go, thinks that if they are permitted to do so, they should be taxed for the privilege. The proposal is that they shall pay the state a tax on earnings. Objection is made to this on the ground that municipal enterprises ought to be tax-free, that in return for tax exemption they provide the people with cheaper power.

But there is another side. If these power plants were not municipally owned, they would be privately owned

and the private owners would pay taxes on the property. The transfer of these plants to municipal ownership simply means that that much property has been taken from the tax rolls. If the state goes on doing that sort of thing, private enterprise will be driven out, along with the taxes private enterprise pays. That is the aim in certain quarters. But even if it is achieved the state will still need revenue. It will get it in one way or another. The people will pay it. There is no other outcome. There can be no system of taxation that will make one certain class pay all the expenses of government with the majority exempt.

The question involved in this power issue is whether the municipally owned plant is entitled to a tax advantage over the private enterprise. If the private enterprise were not subject to state regulation, which it is; if its earnings were not limited by the state, as they are, and if its service were not controlled under the law, the municipal plant would be entitled, perhaps, to state aid, which is what a tax exemption amounts to. But since the state assumes power over the private enterprise and practically takes charge of it, why should the municipal plant be tax exempt? If it is to survive, it must do all the things that private enterprise is supposed to do and do them just as well. It should have no advantage.

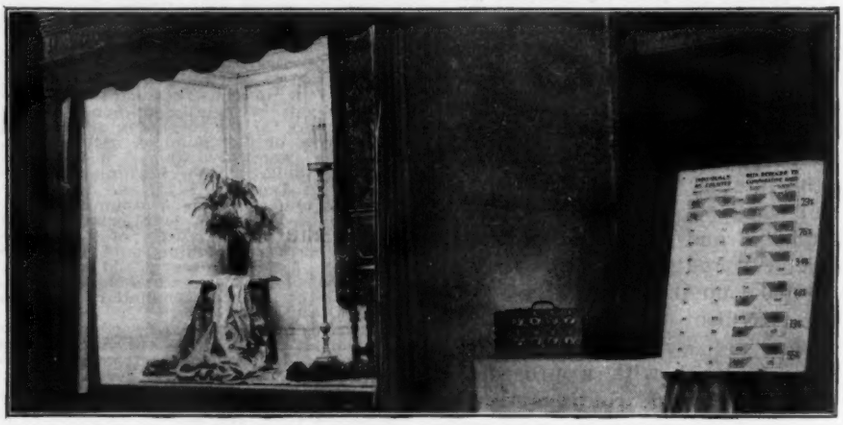
In going outside their own domains Seattle and Tacoma ought to stand on the same basis as any other purveyor of power. Why not? Communities outside Seattle and Tacoma are not concerned with the success of the Seattle or Tacoma power plants, which were designed in the first place to serve the people of those two cities. That is their sole function. With that the people of the state have no concern. But the state is not entitled to give these cities a subsidy in the shape of tax exemption so that they can sell their surplus power outside their city limits. That is especially true when other power concerns stand ready to furnish the service the Seattle and Tacoma city plants want to furnish.

These city-owned plants enter the outside field under the advantage of no taxes at home. They ought to be able to sell power cheaper than other companies, which contribute to the support of the state, without asking a further subsidy from the public. They ought to be able to undersell the private company even with a 5 per cent earnings tax. If they cannot, and it appears they think they cannot then it must be that public control and management of business enterprise is neither so efficient nor so economical as private operation. And that is the truth. The public enterprise, with every advantage on its side, cannot compete with the private enterprise. It never has in this country, and chances are it never will. In order to maintain it at all, the people must pay. But their concern ought to be to get power as cheaply as possible and service as good as possible. Why should they subsidize municipal plants when they can get power as cheap without the subsidy? Why should they care where the power comes from so long as their needs are met at a reasonable price? And why should they dig down in their pockets to pay the taxes the municipally owned plants of Seattle and Tacoma should pay?

Tax exemption as enjoyed by municipally owned utilities is the "ace in the hole" whereby their advocates have been able to show an apparent saving over the privately owned company. How much importance municipal authorities attach to this form of special privilege is indicated by objections raised by Seattle and Tacoma to payment to the state of a tax on earnings which would accrue to them if they extend their lines beyond the city limits.

Portable Exhibit Displays Better Window Lighting

TO EDUCATE the merchants of the state to the advantages of better window lighting and higher intensities of illumination, the California Electrical Co-operative Campaign is using the portable window-lighting exhibit shown in the accompanying illustration. The window is a model in every respect, with equipment of the latest design. It has been made large enough to accommodate a good-sized display and is provided with three types of fixtures used to give low, medium or high intensity of illumination. Daylight lamps with which it is possible to obtain an intensity of approximately 100 foot-candles are used.



PORTABLE WINDOW-LIGHTING EXHIBIT BEING SHOWN THROUGHOUT CALIFORNIA

The display is being shown by the electric clubs of the state at special merchants' day programs which the clubs have arranged. The trimming of the window is done by an experienced window trimmer supplied by some one of the merchants of the city, and the display is in charge of a special demonstrator. The chart shown at the right in the picture gives the results of the survey made in Cleveland last year to determine the relative drawing power of show windows with various kinds of displays and different intensities.

A Bonus Plan to Increase Appliance Sales

TO CREATE and maintain interest in the sale of merchandise, the Pacific Power & Light Company, Portland, Ore., has adopted a plan of merchandising bonuses for employees which became effective the first of the year. In the past the company has achieved good results during periods of campaigns, but it was not practicable to increase the yearly volume of sales to a satisfactory amount by one or two successful campaigns a year. The company operates in eighteen districts in three states — Oregon, Washington and Idaho—and it is expected that the plan will bring about continuous selling effort throughout the year. A brief outline of the bonus plan and average sales during the past six years is interesting.

The amount of the bonus accruing to any district will be a fixed percentage of the merchandise sold in that district. To each district a yearly and quarterly sales quota is given, based on the number and classification of customers served. The bonus money will be distributed quarterly, and in order to qualify the district sales must equal or exceed the quota assigned for the period. The quarterly bonus will amount to 2 per cent of the gross sales, in addition to which 1 per cent will be paid at the end of the year on the amount by which the yearly quota has been exceeded. Provided each quarterly quota is reached, this would mean 2 per cent on the yearly quota and 3 per cent on all over that figure.

The quotas for the districts have been placed much lower than the anticipated sales in 1923, and every district is expected to be able to exceed its quota by a comfortable margin.

It is interesting to note how the quotas given the districts compare with the average yearly sales for the past six years, during which time the Northwest has experienced a variety of business conditions. The tabulation shows the relation between average yearly sales for six years and the quota assigned for 1923.

AVERAGE YEARLY APPLIANCE SALES DURING LAST SIX YEARS

District	Per Cent of 1923 Quota	District	Per Cent of 1923 Quota
Astoria	113	Prosser	224
Dayton-Waitsburg	105	Seaside	97
Goldendale	183	Sunnyside	86
Hood River	91	The Dalles	88
Kennewick	182	Toppenish	105
Pasco	100	Walla Walla	80
Lewiston	130	White Salmon	157
Pendleton	90	Yakima	107
Pomeroy	165	Vancouver	120

It will be seen that in twelve of the eighteen districts the average yearly sales equaled or greatly exceeded the quota established for 1923. No district failed to sell less than 80 per cent of the 1923 bogey. Taking each year's sales separately, it is found that in 1917 thirteen districts exceeded their quota, in 1918 eleven districts exceeded their quota and in 1919 every district went over the mark set. In 1920 all but two districts sold more than the quota allotted to them, and in 1921, the poorest year experienced in the sale of merchandise, six districts exceeded their quota, while in 1922 the number was increased to ten.

Observance of Safety Rules Rewarded by Extra Vacation

EMPLOYEES of the Dallas (Tex.) Power & Light Company engaged in hazardous work who go the entire year without personal injury will be allowed extended time on their vacations as a reward. The announcement of this policy was made by C. E. Gill, vice-president and assistant general manager, at the annual safety meeting of the employees. C. E. Calder, president of the company, addressed the men and paid high tribute to the work of the engineering, construction, organization, distribution and operating departments, which, by adoption of safety methods, have materially reduced the number of accidents and time lost on this account. As an additional incentive to observe safety rules, the sixteen crews in the distribution department will compete in a contest for the best record in the application of safety rules and practices, and suitable rewards will be given members of the winning team.

"Quality" Merchandising by the Central Station

RELIANCE of the public upon the word of the central-station company has long been a potent factor in the growth of appliance sales. That the great majority of central stations are rendering a good account of their stewardship is reason for congratulation within the industry. The accompanying rather unusual advertisement throws a light upon the pursuit of quality merchandise by one of the Tenney companies in Massachusetts and shows the value of testing appliances before putting them upon the sales floor.

Here's a strange advertisement

It tells about an article we'll never sell you

A manufacturer of household appliances was very anxious to have us sell his electric iron.
We submitted his iron to tests in our laboratory. It was satisfactory in many respects. But—we quote the laboratory report—
"The nickel plating is insufficient to prevent the surface from rusting."
So that's why we'll never offer that iron for sale. You can't buy it from us.
Our business depends on your satisfaction. We take care to offer only such articles as give true value and efficient service.

Suburban Gas & Electric Company

C. F. Chisholm, Mgr.

Telephone Revere 145 or Ocean 254

What Other Companies Are Doing

Hartford, Conn. — The appliance department of the Hartford Electric Light Company in 1922 had a very successful year, passing its bogey of 10,000 sales by 247. Following are the numbers of the principal appliances sold: 4,034 flat irons, 1,124 cleaners, 1,061 portable lamps, 834 radiators, 589 toasters, 271 percolators, 244 washers, 299 heating pads, 44 electric ranges.

Springfield, Ill.—The Central Illinois Public Service Company sold 18,763 shares of its preferred stock in its own territory during the year 1922. This is 300 per cent greater than the sales for any previous year. The company's stockholders increased in number from 2,355 to 4,541. In addition, there were at the end of the year, on account of these and other sales, 5,643 subscribers for stock on the partial payment plan. A total of 993 employees sold one or more shares each during 1922. The company had at the close of the year stockholders and subscribers for stock in the ratio of one for less than nine electric customers served.

Malden, Mass. — In a recent house-wiring campaign under the auspices of the Malden Electric Company the owner of fifty-four dwellings authorized the minimum installation of three floor outlets per home, which formed the basis of the development of business under central-station and contractor-dealer auspices. Tenants were left free to expand the initial installation and in many parts of the company's territory the three-outlet initial installation was regarded as only a starting point by the local public.

Texas. — The Texas Power & Light Company recently completed the reconstruction of its offices at Denison, Taylor and Sweetwater to provide the best possible accommodations for customers both for routine transactions and for the merchandising of appliances. In the case of the Denison office the company arranged to move from a side street to a site in the center of the business section. The office chosen was completely renovated and arranged for the attractive display of electrical merchandise. G. B. Richardson, the company's merchandise sales manager, argues that every customer who comes in to pay a bill is a possible purchaser of energy consuming appliances and that facilities should be provided for their careful inspection.

Astoria, Ore.—At the recent meetings of the Commercial Section of the N. E. L. A. at Denver John V. Strange of the Pacific Power & Light Company of Portland, Ore., brought out an interesting condition with regard to electric bake ovens as a result of the fire which recently destroyed the business section of Astoria. The company supplies both gas and electric service in the city, and, desiring to retain as much gas business as possible in the reconstruction after the fire, gas rates for industrial uses were reduced to below pre-war rates. In spite of this fact every commercial bake oven which will be installed will be an electric oven.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Design of Structural Supports for Turbo-Generators.—The relative merits of the three common types of foundations or pedestals for steam-turbine units—that is, reinforced concrete, structural steel and composite construction, are discussed in this paper, which was presented by E. H. Cameron before the American Society of Civil Engineers on Dec. 20. The restraint of vibration, provision for repair of auxiliaries and restrictions of deflections should be the controlling factors of the design. The author suggests that the basis of comparison in deciding on a type of pedestal for a turbo-generator installation should be solely utility or fitness, rather than relative cost.—*Power,* Jan. 23, 1923.

Water Developments on the St. Lawrence River. — NEWTON FUESSLE. — A general discussion of the hydro-electric development that is being considered on the St. Lawrence River. Virtually 5,400,000 hp. is available and if totally developed it would save 54,000,000 tons of coal each year. The article was written following an interview with Hugh L. Cooper on the subject.—*Outlook,* Jan. 31, 1923.

Modern Jet Condensers in Small Lighting Plants.—R. E. HELLMER.—Condensing equipment is essential to the economical operation of a steam-power plant. There are two classes of condensers, namely, surface and jet types. The question as to which is the better type to employ in a particular power plant should be determined wholly by the operating conditions that exist at the plant. The author describes a variety of installations using the jet type of condenser, particularly small power plants.—*General Electric Review,* January, 1923.

Generation, Control and Switching

Voltage Maintenance on Direct-Current Systems.—P. J. ROBINSON.—The problem of maintaining a constant voltage over a network and keeping down costs has resulted in the installation at Liverpool of an automatic substation. The equipment of the station includes one 500-kw. rotary converter, coupled through a transformer to a 6,000-volt, three-phase, 50-cycle supply on one side and to a three-wire, 460-volt direct-current circuit on the other. An electrically operated oil switch with an alternating-current closing coil is used to control the rotary converter. Other apparatus includes a three-phase transformer for the various instruments, isolating switches, a low-tension direct-current panel for the rotary converter, low-tension feeder panels for control of the four three-wire feeders, etc.—*Paper presented before the Institution of (British) Electrical Engineers,* Feb. 1, 1923.

Remote Supervisory Control.—J. L. MCCOY. — The author describes a method by which there are transmitted a series of low-frequency impulses which are interpreted by electro-mechanical apparatus at the receiving end of a system, thus enabling a load dispatcher at all times to control the system. When initiated these impulses cause the actual operation at remote points. The receiving apparatus in such cases translate the series of impulses directly into an operating impulse, performing the desired switching operation.—*Electric Journal,* February, 1923.

Transmission, Substations and Distribution

Transformer Designed to Conserve the Oil and Eliminate Explosions.—W. M. DANN.—On account of the number of explosions of serious nature in power transformers a new type of transformer has been designed for the prevention of disasters. The author first considers the conditions producing explosions and then describes the transformer, in which inert gas such as nitrogen is employed over the oil or in an expansion tank. A compartment containing a deoxidizing material is mounted on the wall of the tank and is connected to the nitrogen space by means of pipes. Within this compartment is a valve which by means of a mercury seal isolates the nitrogen body from the atmosphere within certain predetermined limits. A dehydrator is placed in the connections between the deoxidizing compartment and the gas space to remove all traces of moisture from the ingoing gas.—*Electric Journal,* February, 1923.

Predetermination of the Heating of Self-Cooled Transformers. — R. KÜCHLER.—The author develops formulas for the calculation of the heating of tanks, cores and windings of core-type, oil-immersed, self-cooled transformers. Tested on fourteen standard transformers of well-known make, the different formulas come in 60 per cent of the cases within about one degree of the observed value. In the remaining cases considerable discrepancies occur, but the author ascribes these to measuring inaccuracies. — *Elektrotechnische Zeitschrift,* Jan. 18, 1923.

The Lead-Cable Borer in California.—H. E. BURKE, R. D. HARTMAN and T. E. SNYDER.—Experiments indicate that the cable-borer beetle is able to penetrate any lead alloy used as a cable sheathing or any poison or repellent placed on the sheathing. The greatest damage done by these beetles is to the lead sheathing of telephone cables in California. The extensive report gives a review of the injury done throughout the world to metals by boring insects, damage by the California lead-cable borer to trees and forest products, a history of the beetle and an account of the investigations.—*Bulletin No. 1107 of the United States Department of Agriculture.*

Units, Measurements and Instruments

Spectro-Photo-Electrical Sensitivity of Some Halide Salts of Thallium, Lead and Silver.—W. W. COBLENTZ and J. F. ECKFORD.—This paper narrates the results of a study of the effect of crystal structure, chemical constitution and atomic weight upon spectro-photo-electrical sensitivity. It was found that the photo-electrical reaction on the above salts is confined to a very narrow region of the violet end of the spectra, being the narrowest and most sharply defined electrical spectrum of all substances yet investigated.—*Scientific Paper No. 456 of the Bureau of Standards.*

Apparatus for Calibrating Alternating-Current Meters.—W. SKIRL.—In calibrating alternating-current meters it is customary to provide a separate current and voltage circuit. Aside from a decided saving in current, this method permits an easy and independent regulation of current, voltage and phase displacement. Special transformers are described to regulate current and voltage in a great number of fine steps from zero up to the full meter rating. Motor-generator sets with one rigid and one adjustable stator are described which serve to obtain any desired phase displacement. The author describes some actually built single and three-phase testing switchboards and gives their complete wiring diagrams.—*Siemens Zeitschrift,* December, 1922.

Motors and Control

Direct Current.—O. POLLOK.—The author shows that while for high-tension transmission three-phase alternating currents are beyond dispute the best system, transformation into direct current for motor drives has many and valuable advantages over the use of three-phase motors. The necessary small air gap of induction motors, the lack of speed regulation, the very poor power factor at low or no load, their straight motor character without the possibility of generative braking, the 50 per cent larger number of starter contacts and connections, are all decided disadvantages as compared with the direct-current motor. The latter has been much improved with the introduction of commutating poles, and the usual troubles with the commutator do not exist with well-made, modern direct-current motors. For the drive of tool machines, if three-phase motors are

used, a large number of gears, gear cases, friction clutches, fly wheels, etc., are usually required, in order to obtain the necessary number of speeds. As an example, a milling-machine drive is shown with twenty-four gears, six shafts, two clutches and four operating levers, which give sixteen different speeds from 5.5 r.p.m. to 200 r.p.m. of the spindle. A similar drive, equipped with a variable-speed direct-current motor, contains only nine gears, two shafts and two levers and gives 120 speeds between 5.5 r.p.m. and 200 r.p.m. of the spindle. The drive of a 3-ton crane is mentioned where a 22½-hp. direct-current motor gave the same hourly lifting output as a 45-hp. three-phase motor, the latter consuming 40 per cent more watt-hours. A saving in current of from 35 per cent to 40 per cent can be realized by driving feeding rolls on blooming mills with direct-current motors instead of induction motors, aside from the much simpler controlling apparatus for direct-current motors. It is emphasized that the safety of a drive depends not only upon the reliability of the motor itself, but also upon that of the necessary control apparatus, which is much greater for a two-wire direct-current system.—*Elektrotechnische Zeitschrift*, Jan. 11, 1923.

Illumination

Adequate Street Lighting a Municipal Necessity.—F. M. REAST.—Effective lighting for streets and highways is of the utmost importance to every town and city. Based on a recent report of 3,223 fatalities which occurred during the hours of darkness in a large number of cities in the United States, it was found that 15.6 per cent were directly attributed to lack of sufficient illumination. This indicates very pointedly the conditions that must exist in localities where effective lighting facilities are not available.—*Central Station*, February, 1923.

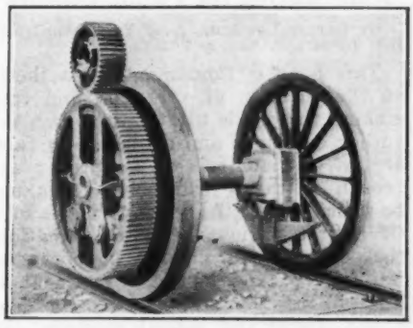
Electrophysics, Electrochemistry and Batteries

Preparation and Properties of Pure Iron Alloys.—W. L. CHENEY.—The author discusses the results of a study of the effect of heat treatment and chemical composition on the magnetic properties of a series of unusually pure iron-carbon alloys ranging from pure iron to 1.6 per cent carbon. Magnetization curves and hysteresis data were taken after each heat treatment and microscopical analysis were made after certain selected heat treatments. The hardened alloys when drawn back to successively higher temperatures showed marked changes in the normal induction, residual induction and coercive force which correspond to transformations of the material. They also showed variations in the maximum intensity of magnetization as computed from the reluctivity relationship. Microscopic analyses confirmed in the majority of cases the fact that the number of values of intensity indicates the number of constitutents present in the material. Variations in the maximum permeability for some alloys show greater differences than other magnetic quantities. Comparing the magnetic properties with the carbon content, there were found certain changes in these properties as the carbon content was increased.—*Scientific Paper No. 463 of the Bureau of Standards.*

One-Axle Electric Mule.—D. TRAUTWETTER.—A newly developed electric mule is described which has only one axle, to each end of which is fastened a solid rubber-tired double wheel of about 18-in. diameter. A 3½-hp., 60-volt motor is mounted above the axle and actuates by means of a chain a differential worm drive. On each side of the axle is suspended one half of the 36-kw.-hr. storage battery, which, under normal service conditions, is charged every two days. The mule has a pull of 250 kg. on the wheel circumference, weighs 1,500 kg. and develops a speed of 1 m. per second. The operator walks in front of the vehicle.—*Elektrische Betrieb* (formerly "*Elektrische Kraftbetriebe und Bahnen*"), Jan. 10, 1923.

Traction

Individual Axle Drive for Locomotives.—In the new drive described the motor is between the wheels of the driven shaft and connected to it over a single reduction gear, the large wheel of which is outside of the axle journals. The pinion on the motor is not keyed solidly to the shaft, but contains four intermediate springs. The large gear wheel is connected to the driven axle by a somewhat complicated lever mechanism, which permits a considerable misalignment between the centers of the gear and the wheel in every direction. Sixteen distinct advantages of this drive are enumerated, and locomotives of the same power output, one with the conventional rod drive, the other with the new drive, are compared. The first locomotive built with this individual axle drive has recently been inspected after running 66,000 miles, and no traces of wear have been noticed, nor was it necessary to make any readjustments.—*Brown-Boveri Mitteilungen*, January, 1923.



SET OF LOCOMOBILE DRIVING WHEELS WITH OUTSIDE GEARING

An Analysis of Regenerative Braking on Electric Locomotives.—C. E. FAIRBURN and F. A. HARPER.—As a result of extended investigations, characteristic curves of locomotives regenerating energy used for braking have been made for the authors. Motor characteristic curves which show the horsepower, tractive effort, speed and efficency plotted against the current input are well known, and the problem of regenerative braking is handled in a similar manner. The mathematical solution of the curves developed is given.—*English Electric Journal*, Vol. II, No. 2.

New York, London, Paris and Berlin Transit Compared.—D. L. TURNER.—In the matter of transportation methods a somewhat different condition prevails in this country from that in Europe. Attention is directed to some of these points of difference in a report presented before the New York Transit Commission by the author, who spent some time in Europe studying city transit conditions. One striking point brought out is the far more strict adherence to rules on the part of European crowds. Another point of difference is the better methods used by European railways to give travelers the information they want. This is done in a variety of ways—by signs on the cars, maps in poster form, direction signposts and other methods which make traveling by street car abroad easy for the stranger.—*Electric Railway Journal*, Jan. 13 and Jan. 27, 1923.

Telegraphy, Telephony, Radio and Signals

Standardization of Wavemeters.—A. TSUBOUCHI.—The establishment of an accurate standard wavemeter is based on calculating the inductance and measuring the capacity of a standard wavemeter and computing the wave lengths from these quantities combined. For checking or correcting the wave lengths harmonics drawn from a triode generator are made use of. Thus the range of wave lengths from about 200 m. to about 22,000 m. are covered by the standard wavemeter. In order to cover a wide range of wave lengths a series of eight standard coils of simple forms with larger inductance than that of the square coil has been made. Combining these series of coils and the standard condensers, the required range of the standard wavemeter has been covered.—*Research No. 115 of the Electrotechnical Laboratory*, Tokyo, Japan.

Permissible Telephones for Coal Mines.—The Bureau of Mines is prepared at its Pittsburgh experiment station to conduct inspections and tests of telephones designed for use in coal mines. A telephone submitted for permissibility tests is to be so designed and constructed that under no circumstances can its normal operation cause ignition of either dust or gas, or a combination of dust and gas, in the surrounding mine atmospheres. A thorough inspection of the telephone will be made to determine its adequacy and permissibility. Tests will be made to check the electrical characteristics and constants of the various parts, and to determine the adequacy of the insulation and of other parts or features of the apparatus.—*Schedule 9-A of the Bureau of Mines.*

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

Electrical Engineering Laboratory Experiments

By C. W. Ricker and Carlton E. Tucker. New York: McGraw-Hill Book Company. 310 pages, illustrated.

This book is a commendable compilation of the usual laboratory experiments for engineering students. With each experiment is sufficient explanation to guide the student who has not thoroughly studied the theory connected therewith. At the end of each experiment a list of the results required is given, subdivided into several parts. This permits an instructor utilizing the book as a laboratory manual to assign certain parts for a given laboratory period or for a given group of students. Other parts may be entirely omitted or assigned at some other time. Thus the book is adapted to the use of many different types of classes and also indicates to the student the portion of the standard tests which he is not required to perform, leaving no doubt in his mind that he has not mastered the complete field. The list of additional references is very desirable for the student who wishes more information on the subject at hand.

Naturally the laboratory manual must be based on the apparatus available to the student for the performance of the experiment. Although the experiments are of a quite general nature, it is obvious that the writer has in mind perfectly definite apparatus. This is as it should be, and any institution utilizing a book of this nature should keep this fact in mind, making such modifications as may be necessary.

Many institutions prefer the loose-leaf manual of instructions containing little or no theory. Such sheets can be filed with and as a part of the complete report. The advantage of the bound manual is its availability for reference.

R. G. WARNER

The Twelve-Hour Shift in Industry

By the Committee on Work Periods in Continuous Industry of the Federated American Engineering Societies. New York: E. P. Dutton & Company. 302 pages.

The title of this book is a misnomer. It treats chiefly of eight-hour shifts and gives no economic or engineering reasons for changing from the longer to the shorter work period. Such reasons as are vouchsafed are sentimental and humanitarian, and these appear unwieldy instruments in the hands of engineers. Where good management and co-operation of labor prevail a shorter day has proved advantageous; but how much credit is due to management, good relationships, labor-saving devices, etc., and how much to the shorter period of labor, is hard to determine. From 5 to 10 per cent of industrial work is on processes requiring continuous operation, and of the men engaged in such work only one-half to one-third operate on twelve-hour shifts, so that the argument is directed to only a small part of industry. That part comprises the iron and steel works, and there the plea is hardly necessary, because those in authority are already convinced of the necessity of a change to a shorter work period. Judge Gary of the United States Steel Corporation has addressed the presidents of the subsidiary companies on this point as follows: "I am not going to argue in favor of the twelve-hour day. I am opposed to it if and when it can be eliminated, not because I think it is necessarily harmful but largely for the reason that there is more or less public sentiment against it." Public opinion will be more potent in effecting a change than any engineering study, and the present volume can add little in the way of argument and proof to minds already made up upon the desirability of an eight-hour day.

Rate Making for Public Utilities

By Lamar Lyndon. New York: McGraw-Hill Book Company. 209 pages.

This book is fundamentally a thesis on the question of valuation and rate making for public utilities in which the author expounds and explains—in fact, argues—his analysis of the proper approach to these problems. It cannot be gainsaid that the whole thesis is fair. Of all the various bases of valuation, that which will clearly support the integrity of the honest investment is held to be the most sound on economic, social and ethical grounds. In the treatment of his subject the author indulges in few generalities, but confines his statements and arguments to the various phases and elements of valuation and rate making. There is never any doubt as to what is being talked about or said. In his foreword the author says the book "is not partisan in any respect," but that "at first glance it might appear that this book is antagonistic to the public service corporations." It is not hard, though, to agree with him that "such, however, is not the case," if the public service corporation's real interests are considered.

The author does not hesitate to criticise, and try to educate, both public utility engineers and engineers for the public. He takes a justified fling at engineering experts who "claim that they can tell by inspection how far a plant has depreciated. They can look it over and say, at once and without hesitancy, just what condition it is in, just how much of its life has expired and what its remaining value is, and these statements they can make so surely and definitely that they testify under oath, in court, that these statements are facts and truly so."

There are closing chapters on rate making for gas supply, for electrical supply, for electric railways and for telephone service, in which the individual characteristics of each utility service are carefully analyzed. This is a book which any one who has anything to do with public utility economics, operation, control or criticism should not fail to read. It should do much to prevent divergence between engineers for the public and engineers for the public utility.

H. V. BOZELL.

Freileitungsbau Ortsnetzbau

By F. Kapper. Third edition. 368 pages, 364 illustrations, 2 plates and 53 tabulations. Munich and Berlin: R. Oldenbourg.

The fact that this book has had three editions within seven years well bespeaks its popularity. The author covers the vast subject of dimensioning and installing of main and distribution lines in a comprehensive and simple manner, interspersing constantly actual examples of existing lines and network. A great many valuable working drawings are included in the text, such, for example, as steel-tower constructions for long-distance spans. The use of survey instruments and methods for the quickest lay-out of the right-of-way of lines are among the subjects treated in the twenty-seven chapters. A useful book for the construction engineer in the field.

A. PALME.

New Electric Power Handbook

Cleveland: The Electric Power Club. Fourteenth edition. 364 pages.

This volume, which is given without charge to consulting engineers, architects, electric light and power companies, educators and rated electrical contractors and dealers, covers substantially all the standardization the club has effected in electric motors, motor pulleys, generators, transformers, electric tools, mining and industrial locomotives, control equipment, power switchboards and switching equipment manufactured in this country. The handbook also contains definitions, symbols, general engineering recommendations and other information needed by users and purchasers of electric power apparatus and control equipment.

Books Received

La Force Motrice Electrique dans l'Industrie. By Eugene Marec. Paris: Gauthier-Villars et Cie. 613 pages, illustrated.

The Advance in Electricity Since the Time of Franklin. By John Trowbridge. Cambridge and New York: Harvard University Press. 183 pages.

"Mechanical World" Electrical Pocket Book, 1923. London: Emmott & Company, Ltd. 326 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Merger of Illinois Utilities

Illinois Power & Light Corporation Organized to Take Over McKinley and Studebaker Properties

SENATOR McKINLEY and others associated with him are proposing a consolidation of the southern Illinois properties controlled by Clement Studebaker and his associates with the properties of the Illinois Traction Company.

The plan provides for the retirement or exchange of approximately $50,000,000 of securities and the creation of a new company, all of whose common stock will be owned by the Illinois Traction Company.

All of the operating properties of the Illinois Traction Company in Illinois will be consolidated into one company, to be known as the Illinois Power & Light Corporation, which will acquire through consolidation the properties operated by the Southern Illinois Light & Power Company. To accomplish this consolidation and to establish a proper foundation for a new first and refunding mortgage for the consolidated operating company, including the creation of an attractive preferred stock, it is planned to acquire approximately $22,000,000, par value, of bonds and to call for redemption a further $9,000,000 of bonds now in the hands of the public. It is also proposed to acquire approximately $9,300,000 of guaranteed preferred stock issued by subsidiary companies and $1,641,000 of preferred stock of the Illinois Traction Company. All these holdings will either be canceled or pledged under the new mortgage. In addition it will be necessary to provide for the retirement of $5,649,000 of Illinois Traction preferred stock, $2,169,000 of Western Railways & Light preferred, $1,665,000 of Southern Illinois Light & Power preferred and $631,000 of Bloomington & Normal Railway & Light preferred, all of which are now in the hands of the public. The intention is to offer the holders of these securities in exchange therefor a like amount of 7 per cent cumulative preferred stock of the new Illinois Power & Light Corporation.

For legal reasons it will probably be necessary for the Illinois Power & Light Corporation to control through stock ownership the Illinois interurban railways and the utilities operating in states other than Illinois.

The capitalization of the new company, subject to the approval of the Illinois Commerce Commission, is given in the accompanying table.

CAPITALIZATION OF ILLINOIS POWER & LIGHT CORPORATION

Divisional bonds (including Southern Illinois Light & Power bonds)	$36,414,800
First and refunding mortgage 6 per cent bonds	30,000,000
Thirty-year 7 per cent sinking-fund debentures	10,000,000
First preferred 7 per cent cumulative stock, par $100	17,678,500
Participating preferred stock, 6 per cent cumulative, par $50	1,865,500
Common stock, no par value	400,000 shares

Alabama Power Company to Reduce Retail Power Rates

Reduction of the cost of electric power furnished under retail power contracts by the Alabama Power Company and the Sheffield Power Company is provided for in a formal order issued by the Alabama Public Service Commission last week following an agreement with the companies. The rate follows: Demand charge, $1.50 per month per kilowatt, plus energy charge, 3 cents per kilowatt-hour for the first 1,000 kw.-hr. consumed per month, plus 2 cents for the next 4,000 kw.-hr., plus 1 cent for the next 15,000 kw.-hr., plus 0.9 cent for the next 30,000 kw.-hr. It is specified that the demand shall be determined by either inspection or demand meter, but in no case shall it be less than 1 kw.

Committee on Insulation Is at Work

During the midwinter convention of the American Institute of Electrical Engineers held at New York last month there was a meeting of members of the committee on insulation of the National Research Council. This committee numbers about forty men, but it is to a small active group among this large membership that the Engineering Division of the National Research Council looks for the pushing of the work. Those present at the meeting were J. B. Whitehead, chairman of the committee; G. B. Shanklin, F. M. Farmer, W. A. Del Mar, R. W. Atkinson and A. D. Flinn, chairman of the Engineering Division. Their preliminary report, as prepared by the chairman, will be a general statement of the important problems in the field of insulation attacked from the simplest fundamental aspects with specific suggestions of problems for experimental approach. The more complex questions continually propounded by the industries will be left for a later date.

Ford Gets High Dam

Preliminary Permit Granted as Concession to Sentiment in Twin Cities —Rigorous Conditions

WHAT is very apparently a concession to public opinion in the locality affected was made by the Federal Power Commission in awarding a preliminary permit to Henry Ford covering the High Dam project in the Mississippi between Minneapolis and St. Paul. To guard against non-use such as has followed the construction of the Ford dam at Troy, N. Y., and to safeguard the public interest in other ways, the commission imposed very strict conditions.

In the first place, provision is made to insure the maximum possible utilization of the power. Mr. Ford is required to install four units with the maximum capacity of 4,800 hp. This is all the power that can be developed without extensive and expensive changes in the dam. A further condition imposed by the commission is an annual charge of $95,500 for the use of the government's dam. Mr. Ford is also required to put in a tailrace 2,000 ft. long, so as to prevent the silting up of the navigation channel and the lock. The commission feels that these rather rigorous conditions are necessary in order to insure the use of the power in the public interest.

Northern States May Buy Power

Mr. Ford is required by the permit to apply for license before July 1. On that date he must present executed contracts for the sale, delivery and use of the maximum power that can be delivered at the dam. This probably means that a large block of the power must be sold to the Northern States Power Company. That company is understood to be ready to purchase such power as Mr. Ford has to sell, but since it is now securing dump power for 2½ mills per kilowatt-hour, delivered, it was brought out clearly at the hearing that the company would not be willing to pay a higher rate to Mr. Ford. It could be discerned that the Northern States Power Company has some apprehension as to what might develop if one or both of the municipalities adjacent to the High Dam should receive power for general use.

Doubtless with some of the extravagances of another Ford development in mind, the commission required as a condition of the preliminary permit that the development be made along the most efficient and economical lines.

Chief Engineer Mayo of the Ford

staff, who appeared in his behalf, told the commission that it is the expectation to use the power principally in electric furnaces. No attempt was made to explain why Mr. Ford is desirous of resorting to hydro-electric power for his St. Paul plant when engineers' estimates are that it will cost three times more than the power he could develop from coal at such a plant.

The president of the University of Minnesota and Representative Newton of that state made vigorous pleas for the reservation of power for the university's use and of a turbo-generator site to permit the university to carry on extensive experiments of a hydro-electric character. This plea was not granted. Under the law the commission has no right to place charges on a licensee in addition to those prescribed in the act.

Governor Smith's Views on Water Power

Favors State Ownership, Development and Limitation—To Continue Fight Against Federal Control—Wants Private Lines Made Common Carriers

GOVERNOR SMITH'S long-awaited message on water power was sent to the New York State Legislature last Tuesday. A remarkable feature of the message is that the issue of cost receives scant consideration. The Governor asks for an "adequate appropriation" to begin the work, but the vital question of when and how $150,000,000 is to be raised is not answered. Another outstanding feature of the message is the Governor's proposal that existing private transmission lines be made common carriers and regulated as such by the state. He opposes exportation of any power beyond the boundaries of the state.

THE GOVERNOR'S RECOMMENDATIONS

Declaring that the state should at once develop the power resources on the Niagara and St. Lawrence Rivers for transmission to every municipality in the state over lines owned and controlled by it, the Governor makes, in brief, the recommendations which follow:

First—That appropriate legislation be enacted to carry out this policy. "To do this will require an adequate appropriation of public funds made immediately available."

Second—That the State Engineer be charged with the duty of beginning development work and negotiating with the federal government for consent to develop hydro-electric power on these streams consistent with its control over these waters for navigation.

Third—That, pending the development of all these powers, existing transmission lines should be declared common carriers by law and compelled to transmit electrical energy at a reasonable rate.

Fourth—That no further permits or licenses for the development of power should be granted to any private corporation, existing statutes providing for such grants to be repealed.

Fifth—That $75,000 be made immediately available to the Attorney-General to enable him to defray the expenses of the action now pending and begun by the state against the federal government to determine the jurisdiction of the state over the navigable waters within its borders for power development.

On the last recommendation the Governor says:

"This action should be prosecuted with the utmost care, vigor and dispatch in order that this vital question be finally determined. We have already delayed too long. While we have been debating and bickering over the enactment of laws for the progressive development of our great water power under state ownership and control, the federal government has enacted a water-power law which challenges our right, authority and jurisdiction over the navigable waters of our state in all matters relating to power development.

"The federal government contends that it has the right, authority and jurisdiction to control and dictate by license how, when and where developments are to be made on the Niagara and St. Lawrence Rivers, as well as all other navigable streams of the state. Such right and authority, if sustained, would enable the federal government to deprive the State of New York and its people of this priceless heritage bestowed upon us by the Creator himself. In the final analysis it would permit the federal government to divert the energy created by the fall of water in our streams to other states against our will. The bed of our streams over which power-creating water flows belongs to the state, or, better still, to its citizens. Our use and control of the same is threatened. I am credibly advised that a strong and determined propaganda is now being spread in support of a plan to divert the electrical energy from our border streams to territory outside the state. This we must resist with all the power that we can bring to our command.

"No pending public question is of more moment to the people of this state than the development of this great resource. It has been exploited in the past in the interest of private corporations that have operated it for private gain. What remains of it must be developed in accordance with the enlightened thought of today, and that, I take it, is by the state itself, under state ownership and state control, to the end that all of the people may be able to realize the individual benefit which should flow to them from their own resources and their own property."

After an investigation now in progress with respect to the development of power from the surplus canal waters at Crescent and Vischer Ferry, the Governor will prepare a message on that subject.

Immediate action by the state for the development of hydro-electric power and its sale to municipalities for distribution to private consumers was urged by the New York State Mayors' Conference at its mid-winter session in Albany on Wednesday.

UTILITY BILL FOR NEW YORK CITY

Public utilities in New York City other than transit lines will be regulated by a single-headed department of public utilities if a bill introduced on Tuesday by the Democratic leaders shall become law.

The New York City Public Utilities Commission would be an appointee of the Mayor, but, like the New York City transportation bill, this measure provides that the Board of Estimate shall have the power to increase the number of public utilities commissioners exercising supervision for the city.

The bill gives to the city the power to own and operate gas and electric light plants and other utilities. The Board of Estimate could initiate steps for their construction or acquisition when it deemed such action advisable. As in the transportation act, the board appears to be the sole judge of the timeliness and need of such steps.

All the powers now exercised by the Public Service Commission in regard to public utilities within New York City are transferred to the prospective New York City Department of Public Utilities, which would control rates as well as the operations of such corporations.

Surveys in Two States

Pennsylvania and Massachusetts Contemplate Further Development of Hydro Resources

GOVERNOR PINCHOT of Pennsylvania has requested that the Legislature provide a special appropriation of $35,000 to carry on an outline survey of water and fuel resources available for Pennsylvania and of the most practicable means for their utilization for power development.

The Governor explained that the purpose is to conduct a careful study of power development possibilities both within and outside the state, expressing it as his opinion that the development of Niagara Falls, the Delaware, Susquehanna and Potomac Rivers and other sources of power is of as great interest and value to the state as if these sources were entirely within Pennsylvania.

"Such a survey should point out the way to secure for all industries, farms, homes and railroads in all parts of the commonwealth an abundant supply of cheap electrical energy while duly safeguarding existing investments in the electric industry," the Governor said.

A conference was held at Boston on

Monday at the instance of the Associated Industries of Massachusetts on the question of whether steps should be taken to ascertain the possibilities of securing additional power from Massachusetts water sources. The question at issue was whether the manufacturers would care to make a united survey of the situation, which would involve an expense probably of $50,000. President Charles R. Gow of the Associated Industries and President Charles L. Edgar of the Boston Edison company were the principal speakers.

There is a great deal of water power wasting in the state, they declared, which might be transformed into electrical energy, especially since it is impossible to bring electricity from Maine or Canada.

Water Power National, Not Local

Guy E. Tripp, in an Argument for a Superpower System in North Atlantic States, Protests Against Narrow View of New York's Resources

INSTANCING the interconnected system of the Southeastern States, which stretches for more than six hundred miles and embraces Alabama, Georgia, Tennessee and the Carolinas, and the still longer Pacific Coast interconnections as examples of hydroelectric practice that should be emulated in the Northeast, Guy E. Tripp, chairman of the board of the Westinghouse Electric & Manufacturing Company, has just given to the press a protest against narrow state views on the development of the water powers of New York and against basing plans on the engineering practice of 1907 rather than that of 1923.

"Large water powers," Mr. Tripp says, "are no longer merely a local asset. No matter where they are situated, they are, beyond the shadow of a doubt, a resource of the entire nation. It is now economically wrong to restrict the energy derived from them within any arbitrarily chosen limits. This energy must be so distributed that it will benefit the greatest possible number of people.

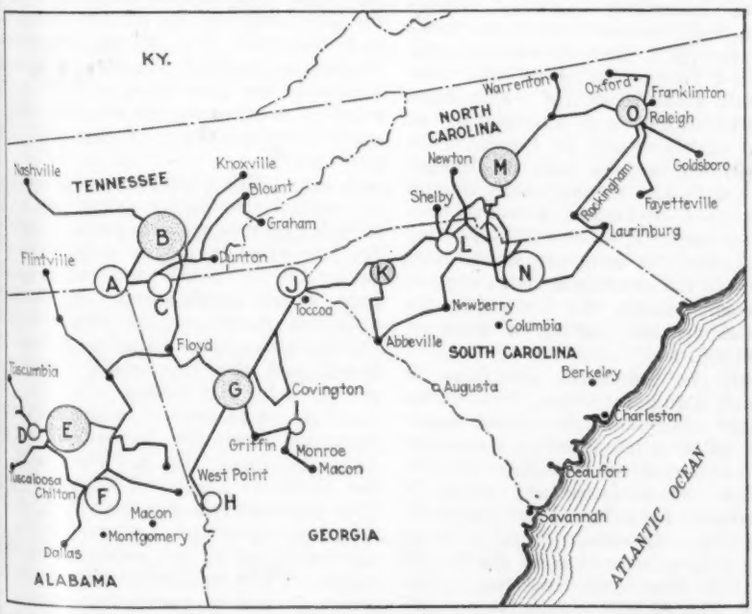
"Water power," he continues, "must be developed on a national, and not on a local, basis. From now on every hydraulic generating station should be designed with reference to a great interstate system of distribution. Engineering science has prepared the way for such a system. It has studied every source of power and every center of power distribution in America, and since it knows or can accurately estimate practically every factor involved, it has devised means for supplying all of the power needed for fifty years to come.

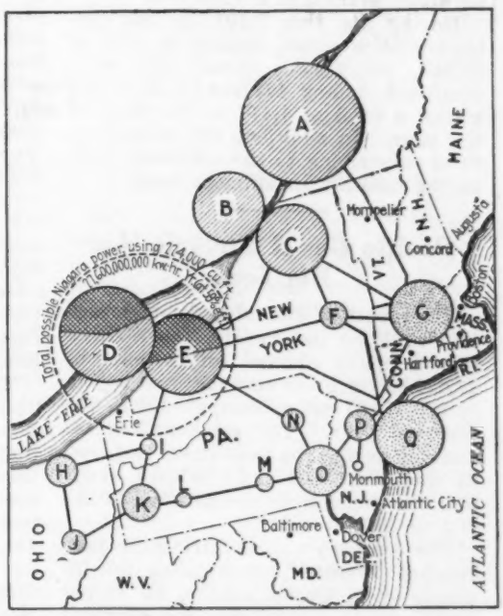
NEW YORK MUST CHANGE POLICY

What is the situation in New York State? Though it has the finest steam and water-power stations in the world, there is no comprehensive co-operation between them. The great Niagara companies distribute power to only a narrow strip lying along the northern border of the state, and the splendid steam plants of New York City serve only the metropolitan section. As things now stand, millions of horsepower are being allowed to run to waste, vast and unnecessary sums are being spent for coal, large areas of the state are unsupplied with electricity, there is danger of power shortages because of lack of coal and other causes in even our largest city, and all through the district, relatively small generating equipments are being installed, only to be replaced by somewhat larger ones, which in turn are soon replaced, causing a continuously pyramiding of capital charges which are borne by the public. Yet, under the encouragement of the state government, together with the co-operation of the various power companies, which will undoubtedly be given, an interconnected power system, unsurpassable anywhere in the world, could be readily formed in this section."

According to Mr. Tripp, the total amount of power generated by the electric systems of New England, New York, New Jersey and Pennsylvania in 1921 was 14,000,000,000 kw.-hr.; the total power of the Niagara Falls and River is 27,000,000,000 kw.-hr. per year, and the total power of the St. Lawrence River is 21,000,000,000 kw.-hr. per year.

Mr. Tripp explains his conception of how New York's water powers should be developed by the use of two maps, here reproduced, one showing the Southern system and the other the suggested North Atlantic system, as explained in the captions. "The plans are complete," he says, "but a leader is needed to put them into execution."





SOUTHERN SUPERPOWER SYSTEM, AND PROPOSED SUPERPOWER SYSTEM FOR THE NORTHEASTERN STATES

In the map on the left hand of the page the white circles (A, C, D, F, H, I, J, L, N) represent the amount of power generated at points indicated; the gray circles (B, E, G, K, M, O) represent amount of power distributed to consumers from the points indicated, which are the principal distributing centers of the system. All circles are drawn to scale. The total amount of power supplied by this system exceeds 2,000,000,000 kw.-hr. a year, most of which is generated by water power.

In the map on the right hand of the page circle A represents the total undeveloped power of the St. Lawrence River lying wholly in Canada. B and C represent the undeveloped power of the border portions of the river belonging respectively to Canada and the United States. The light portions of D and E represent the amount of Niagara Falls power now being used by Canada and the United States; the dark portions represent the amount of Falls power proposed for early development. The inclosing dotted circle represents the total power of the Falls. Circles F to Q inclusive represent the amount of power now being generated and consumed at the points indicated. All circles are drawn to the same scale.

President's Coal Commission Is Continued

While the continuance of the President's Coal Commission was imperiled by the delay in voting its appropriation, Congress in an eleventh-hour effort gave the commission all legislation which it had asked. This included the appropriation of $400,000, the authorization to require sworn answers to questionnaires, the extension of the life of the commission until Dec. 31, and the authorization for Judge Alschuler to serve as a member of the commission. Chairman Hammond said that he can foresee no contingency that will interfere with the submitting of the final report on Sept. 22. There is reason to think, however, that the commission is glad to have additional time made available to provide for delay.

Charts Show Growth of Illinois Northern Utilities

To explain the meaning of its annual report for the year ended Dec. 31, 1922, the Illinois Northern Utilities Company used charts indicating annual growth from 1918. Gross earnings for 1922, including merchandise sales, were $2,129,276, which is an increase of $141,956 over 1921. For the same year the gross revenue from the sale of gas and electricity increased $198,088, or 12 per cent. Net earnings amounted to $707,685 as against $655,426 for 1921, an increase of $52,250. This increase would have been even greater had not the coal strike compelled the company to pay abnormal prices for coal during the latter part of the year. After paying $189,362.92 on preferred stock, a surplus remained of $111,473.69.

During the year 2,101 electric customers were added, making a total of 29,348. Stock sales to customers were continued, adding 491 stockholders and giving a total of 1,477 at the close of the year. In addition, 423 individuals were subscribing to the company stock on the monthly installment basis.

Pacific Gas & Electric Has Big Year

The report of annual earnings issued this week by the Pacific Gas & Electric Company showed an increase of $1,694,898 in gross revenues and a gain of $2,557,107 net as compared with the previous year. The company's gross business during the year ended last Dec. 31 was $39,204,605 and balance available for common dividends was $4,013,003, or 11½ per cent.

The company's sales during the year reached 1,098,000,000 kw.-hr., an increase of 76,300,000 kw.-hr., or 7½ per cent, as compared with the previous year. The net addition of 46,295 customers during 1922 exceeded all former records. Total customers served as of Jan. 31 were 649,293.

The company's investment in plants and properties on Dec. 31 last stood at $200,250,877. On Dec. 31 last the funded debt was 56.53 per cent of the total capitalization. In 1922 15.3 per cent of gross and 38 per cent of net was required for annual interest on all outstanding bonds as against 25.9 per cent and 61 per cent respectively in 1921. The company has approximately $15,000,000 cash on hand, which it is anticipated will be sufficient to cover its capital requirements for construction work during the year.

Hoover Calls Radio Conference for March 30

Inaction by the Senate having caused the radio control bill passed by the House of Representatives, as reported in the ELECTRICAL WORLD for Feb. 3, page 292, to fail, the House a few hours before the session closed adopted a resolution directing the Federal Trade Commission to investigate and report to the next Congress regarding control of radio patents. The bill that died in the Senate would have vested authority in the Secretary of Commerce to regulate transmission stations through a licensing system. Because of its failure Secretary Hoover on March 6 sent out invitations for a reassembly of the radio conference held a year ago, together with some additional members, to investigate what administrative measures may properly be taken temporarily to lessen the amount of interference in broadcasting. The conference will be held March 20 at 11 a.m. at the Department of Commerce, Washington.

A. T. & T. May Increase Its Stock to $1,000,000,000

The directors of the American Telephone & Telegraph Company recommend in their annual report to stockholders for 1922, just issued, that the authorized share capital of the company, now $750,000,000, of which more than $699,000,000 was outstanding at the end of the year, be increased to $1,000,000,000 to take care of present commitments and future requirements. No new stock offering is, however, contemplated for 1923. With a billion-dollar capitalization, the company would rank all others in the country in share capital, the present leader, the United States Steel Corporation, having a total of $950,000,000.

Taking the American Telephone & Telegraph Company alone, without its associated companies, the report shows that in 1922, after meeting operating charges and making provisions for depreciation, obsolescence and taxes, it had available for interest and dividends $81,668,440. Interest charges were $15,498,012, a reduction of $4,023,097 from 1921, thus reflecting the reduction of $74,095,100 in the company's debt during the year. Dividends paid to stockholders at the rate of $9 per share per year amounted to $52,971,252, an increase of $10,296,849 over 1921, this increase being principally the result of an increase in the outstanding capital stock of $151,162,100.

N. E. L. A. on Code Revision

Objections to Addition to Rule 12-b to Be Made at Public Hearing of N. F. P. A. Committee

AT THE public hearing of the electrical committee of the National Fire Protection Association next Monday, W. H. Blood will present objections of the National Electric Light Association to certain proposed revisions of the National Electrical Code. The requirement which is most objected to is the proposed addition to Rule 12-b, second paragraph, which reads as follows: "Line wires of voltage less than 5,000 volts between wires shall have an approved weatherproof or rubber-insulated covering." The National Electric Light Association requests that this proposed addition shall not be added to the code.

WHY RULE IS OPPOSED

The reasons given for the objection are as follows:

1. The covering consisting of braidings and compound known as "weatherproof" covering is not an insulating material and should not be so described. The fact that this material was at one time considered to be an insulating material is not of present significance, considering the great advance in the knowledge of the properties of insulating materials made during the last few years.

2. It is current good practice among the electricity supply companies to warn all employees that covered wires are to be handled as though they were bare, and this practice is sound on account of the unreliable insulating properties of these coverings. It is only with the utmost difficulty that this wise provision is impressed upon the line workmen and others concerned, and therefore any official expression tending to support the idea that such materials are insulation will have the effect of weakening the earnest efforts made for the safety of line workmen and others.

3. Any slight temporary protection as actual insulation that may be afforded by new weatherproof coverings for line wires is usually more than offset by the increased wind and ice loadings which result from the greater diameter of the covered wire, whereby the lines are more liable to stretch or break and the supporting structures are more heavily loaded.

Attention is invited to the following quotation from the Bureau of Standards Handbook No. 4, "Discussion of the National Electrical Safety Code": "No requirements for provision of insulating coverings for conductors in overhead lnes of any voltage have been made. While such coverings are sometimes an aid in preventing burn-outs, the reduction of hazard derived from their use is problematical. Their use may even cause an added hazard for the higher voltages, as after being in service some years they deteriorate. Their use in this condition gives rise to a false feeling of security. Much

more reliable and effective safeguards against the danger from fallen and crossed wires are the provision of proper wire clearances and separations and the maintenance of these clearances and separations by suitable minimum conductor sizes, sags and strength of supports."

4. During the three years past, when the 1920 edition of the code contained no requirement for the use of weatherproof coverings on line wires, there has been no general tendency to discontinue its use for the purpose to which it was formerly applied, and this is good evidence that there is no desire on the part of the electricity supply companies to abandon this weatherproof covering in the situations where it is useful and appropriate.

5. The proposed voltage limitation of 5,000 is arbitrary and unrelated to any standard distribution voltage and to current good practice. It may have been intended at some former time to provide a figure for demarcation between "distribution" and "transmission" voltages, but if this was the case, it no longer has any significance in that connection or any relation to current good practice. It provides no reasonable line of demarcation between voltages for which covering has a large and only a negligible value.

6. Municipal and insurance inspectors are widely averse to such a rule, as shown clearly in the discussion at the recent meeting of the Western Association of Electrical Inspectors, where stress was laid on the rapid deterioration of line wire coverings and the false sense of security engendered by such coverings. Inspectors of state utility commissions, who deal much more generally with overhead lines both near to and remote from buildings, generally adhere to the provisions of the National Electrical Safety Code and do not require insulating coverings.

7. It is submitted that the applicable parts of the National Electrical Safety Code should govern in this case, no less than as provided in the proposed change in Rule 13 which every one supports and which reads: "It is advised ... that the rules of the National Electrical Safety Code, Part 2, be followed."

8. Finally, it is believed that the proposed revision is entirely too sweeping in its effect and not justified by experience. Such a rule, if included in the National Electrical Code at all, should be drawn only after thorough study and full hearing of all interested parties; that has not been done in the present case.

Another Bill Aimed at Indiana Commission Fails

A bill to enable cities on referendum vote to operate municipal utilities without jurisdiction of the Public Service Commission or to build a utility plant without obtaining its consent has failed in the House of Representatives of the Indiana General Assembly by a vote of 48 to 39. Three more votes would have given the bill the requisite two-thirds majority. A motion to postpone the bill indefinitely was lost, and it may be called up for third reading again at any time by any representative.

The same bill in the Senate is expected to come from committee with a divided report, the majority against it. It is thought to have small chance in the Senate. Governor Warren T. McCray will be vigorously against it.

Federal Board Files Reply

Amended Bill of Complaint of New York Contested in United States Supreme Court

SETTING up the claim that the federal government has authority over the Barge Canal system of New York under the interstate commerce clause of the Constitution, the canal system being a part of an interstate and foreign commerce waterway, Solicitor-General Beck has filed in the United States Supreme Court for the Federal Power Commission an answer to the amended bill of complaint entered by the State of New York to test the authority of the commission. In its amended bill the state had claimed that it had spent great sums on the development of waterways within the state and had projected hydro-electric developments concerning which it claimed the Federal Power Commission had no authority.

The commission's amended answer declares that the bill does not join essential parties in that no determination can be made of the authority of the United States to enter into contracts with citizens of New York for the acquisition of real or other property useful in the preservation or improvement of navigation in the absence of the citizens whose property is affected. The answer further claims that the state does not present any concrete plan regarding its proposal for hydro-electric development or show how such plans would affect navigation. It is pointed out that the United States government spends large sums for the development of navigation in the harbor of New York and on the Hudson River. The state has filed no plans for power development with the commission, the answer says, but private persons have, and these applications are being considered by the commission.

Regarding the state's announced contemplation of hydro-electric development on the St. Lawrence River, the commission's answer sets forth that this waterway has been the subject of an international conference by act of Congress looking toward its improvement for oceangoing transportation and that if the state were to make any effort to construct plants there the commission would seek action by the Attorney-General to determine the effect.

The Federal Power Commission itself does not construct plants, the answer continues, and such construction by those licensed to do so by the commission would not deprive the state of the right of taxing such properties.

Arkansas Light & Power Gets Mississippi Properties

Announcement has been made by H. C. Couch, president, and J. L. Longino, vice-president of the Arkansas Light & Power Company, of their acquisition of the Jackson (Miss.) Public Service Company and the Vicksburg (Miss.) Light & Traction Company. The Jackson company operates the street railway, electric and gas systems in that city and formerly was controlled by the American Public Utilities Company of Grand Rapids, Mich. W. E. Brown of Jackson is the general manager. The Vicksburg company operates the street railway and the electrical systems in Vicksburg and was controlled by the Union Utilities Company of Chicago. E. S. Myers is general manager. It is understood that relinquishment of control of the Jackson properties by the Brewer interests and of the Vicksburg properties by the Elston interests is due to the fact that these were the only properties of these syndicates in the South.

In the reorganization of the Jackson and Vicksburg companies H. C. Couch will be president, J. L. Longino vice-president and general manager, W. E. Baker treasurer, and L. Garrett secretary. These, with C. P. Couch, manager of the Arkansas Light & Power Company properties at Arkadelphia and Malvern, Ark., will comprise the board of directors.

Improvements already started at Jackson will be carried out. A transmission line will be extended west from Jackson to Clinton, and it is probable that another line will be extended east from Vicksburg, interconnecting these two power stations. The Arkansas Light & Power Company will supply electrical energy to the American Bauxite Company for mining and drying bauxite and lighting the town of Bauxite, Ark.

Oklahoma Is Seeking to Tax Utilities on Rate Valuation

Efforts are being made in Oklahoma to force public utilities to return for tax purposes the same property values that are fixed by the Corporation Commission for rate-making purposes. Several bills introduced with this object have been held unconstitutional by the Attorney-General. The judiciary committee of the House has introduced a bill designed to correct the defects in the previous bills. This provides that in all hearings before the commission to fix utility rates the state shall be considered a party adverse in interest to the public utility, and that before an order fixing rates is entered the commission shall enter a judgment fixing the value of the property. Where a report was filed by a utility showing the value of its property, the report would be considered as a confession of judgment and a commission order entered accordingly, except as the commission might desire to dispute the value reported.

Convention Arrangements

Advance Circular from the N. E. L. A. Headquarters Tells of Hotels and Transportation

AN ADVANCE circular on the forty-sixth convention of the National Electric Light Association, to be held in New York City on June 4-8, has been issued by headquarters, and intending visitors are already being urged to secure their hotel accommodations by filling out a form inclosed and returning it to the hotel committee, N. E. L. A., 29 West Thirty-ninth Street, New York. A list of thirty hotels within a radius of a mile of the convention meetings is listed, with their rates. Joseph F. Becker is chairman of the hotel committee.

Convention headquarters will be at the Commodore Hotel, Forty-second Street and Lexington Avenue, immediately adjacent to the Grand Central Terminal, where the business sessions will be conducted, with additional facilities, if necessary, also provided in the Biltmore Hotel, adjoining. The first business sessions of the four national sections will convene early Monday afternoon, June 4, with other section sessions on the afternoons of Tuesday, Wednesday and Thursday. The first general and executive session will be held on Tuesday morning, June 5, with other such sessions following on Wednesday, Thursday and Friday mornings. The important session of the public policy committee will be held on Thursday evening, June 7, at Carnegie Hall, Seventh Avenue and Fifty-seventh Street.

TRANSPORTATION

Godfrey H. Atkin, Electric Storage Battery Company, 713 Marquette Building, Chicago, has accepted the appointment of master of transportation. Mr. Atkin has already made application for a special round-trip rate of one and one-half fares from all points to New York City. A special round-trip fare from all Pacific Coast points to New York City of $147.40 has been agreed upon by the railroads.

It is the intention of the transportation committee to operate special trains from Chicago and Boston for the convenience of the Western and the New England delegates. The master of transportation will be glad to hear from any members who would like to have special trains or special cars operated from their particular sections of the country.

For special information not covered by the circular, A. Jackson Marshall, committee secretary, should be addressed at headquarters.

Insufficient Grant May Hamper California Commission

Some concern is felt in California over the rigorous policy of economy of the new Governor as it affects the State Railroad Commission. The commission's allowance for the next two years is $793,000, which is $234,800 less than the appropriation made for the two years just past and $100,000 less than the minimum requirements estimated by the president of the commission. Ninety per cent of the burden of this cut in the budget falls on the engineering department, whose engineering staff will be reduced from fifty-two to twenty-four.

During 1922 there were 4,950 informal complaints made to the commission, virtually all of which were handled by the engineering department. To curtail the work of this department will, in the view of many, seriously reduce the commission's service to the public and will mean that it will either take a discouragingly long time to obtain the facts in a case or that only part of the facts will be obtained. A decision which is not based on full engineering investigation may, these men point out, be inequitable either to the public or the utility. Personal views of the commissioners might under such circumstances influence their decision, and it is not inconceivable that the commission might in time lose something of its present standing or even degenerate into a political body.

Utility Commission Engineers Confer

Discuss the Grading of Public Utilities in Conformity to Service Rules and Other Utility Problems and Lay Plans for Permanent Organization

PLANS for an annual conference of engineers attached to the state utilities commissions, to be conducted under the auspices of the Bureau of Standards, were laid at a meeting at the Department of Commerce, Washington, on March 2 and 3. It was the consensus of opinion of the engineers of more than one-third of the state commissions that there should be an annual conference at which the technical and engineering questions involved in utility operation could be discussed in the interest of the common good.

OBJECTS OF CONFERENCE

This conference was called by Dr. F. C. Brown, the acting director of the Bureau of Standards. The conferences are to be along the lines of those which have been held for many years, in which the specialists of the bureau have met with the weights and measures officials of the various states with the idea of exchanging views and experiences. In addition to the benefits which will come from the exchange of views among the utilities engineers, it will give them an opportunity to obtain first-hand knowledge of the experiments and research which the bureau is conducting on the public utility problems.

Addresses were made at the meeting by representatives of the Bureau of Standards and by commission engineers. The topic chosen was "Grading Utilities in Conformity to Service Rules." An executive committee was selected to work out plans for future conferences. C. B. Hayden of the Wisconsin commission was chosen as the chairman of this committee, and E. C. Crittenden, chief of the electrical division of the Bureau of Standards, as secretary. Other members are William M. Black of the Maine commission, C. R. Vanneman of the New York commission and A. I. Thompson of the Oklahoma commission.

Other topics on which there was a general discussion were inductive interference and the grounding of electrical circuits. Secretary Hoover opened the conference.

In explaining the relationship of the Bureau of Standards to the conference Mr. Crittenden said:

"The bureau has aimed to do three things, first, to carry out experimental investigations of problems affecting the efficiency of operation, cost and quality of service rendered; second, to determine the facts with regard to actual practice, and, third, to combine the results of laboratory investigations and of field observations with the judgment of trained and experienced engineers so as to formulate recommendations or codes of practice which would safeguard the interests both of utility operators and of utility customers.

"It should be emphasized that the bureau does not seek or desire any authority to impose its findings on others. Its position as an impartial fact-finding and advisory body is believed to be the most useful one for a federal government agency in this field. Such success as the work has attained in the past would have been impossible without the cordial co-operation of utility companies and their associations as well as city and state authorities. The earlier work was done largely with city officials, but as the principle of state regulation has gained wider and wider acceptance, our contacts have naturally shifted to the state commissions."

ENGINEERS IN ATTENDANCE

Commission engineers who attended the conference were, by states: Alabama, I. F. McDonnell; Georgia, J. Houstoun Johnston; Illinois, J. Howard Mathews; Indiana, Earl L. Carter; Iowa, A. B. Campbell; Maine, William M. Black; Maryland, H. C. Wolf, W. F. Strouse, S. A. Covell, Mr. Cullen, L. Ellis, R. Y. Gildea and J. L. Wicks; Michigan, Manfred K. Toeppen; New Hampshire, D. Waldo White; New Jersey, Col. P. Betts; New York, C. R. Vanneman and R. H. Nexsen; Ohio, L. G. White and Ward Snook; Oklahoma, A. I. Thompson; Tennessee, F. G. Proutt; Virginia, J. W. West, Jr.; West Virginia, James Imboden and W. B. Hall; Wisconsin, C. B. Hayden; District of Columbia, E. G. Runyan, and Connecticut, A. E. Knowlton.

City Ownership Is Agitated in Denver

Recent developments in Denver indicate that municipal ownership of public utilities will be one of the chief planks in the platform of several mayoralty candidates in the spring campaign. Governor Sweet is out with a statement that he will not favor any candidate who does not stand for this policy. During the term of the next Mayor the franchises of both the Denver Tramway Company and the Denver Gas & Electric Light Company will expire, and it is likely that the traction system, although in the hands of a receiver, will receive the first attack, with the central-station company second.

Both Governor Sweet and Frank N. Briggs, a prominent Denver banker who has announced his independent candidacy for Mayor, have declared their belief that regulation and control are positively unsuccessful. Many years have elapsed since a fight was waged against the public service corporations in Denver, and the results of the coming campaign will determine the character and intensity of the effort to be made by public utility companies in the near future for the acquisition of new franchises.

Mr. Briggs recently addressed the Denver Section of the A. I. E. E. in support of his views, taking as his subject "Possibilities of Denver as an Electrical City."

Illinois Utilities to Hold Convention Next Week

A joint convention of the Illinois Gas, Illinois State Electric and Illinois Electric Railways Associations will be held at the Hotel Sherman in Chicago Wednesday and Thursday, March 14 and 15. At the joint morning sessions Charles M. Thompson, dean of the College of Commerce and Business Administration, University of Illinois; Ralph E. Heilman, dean of the Northwestern University School of Commerce; Martin J. Insull, vice-president Middle West Utilities Company; Britton I. Budd, president Chicago Elevated Railroads; E. W. Lloyd, chairman Joint Committee for Business Development; George R. Jones, chairman public speaking bureau of Illinois Committee on Public Utility Information; E. Hill Leith of Halsey, Stuart & Company, and B. J. Mullaney, director Illinois Committee on Public Utility Information, will speak.

The program of the electric section of the convention follows: "Survey of Appliances and Their Use in Residences in Chicago," H. B. Gear, Commonwealth Edison Company; "Development of the Mazda Lamp, Introducing the New 30,000-Watt Lamp," F. T. Benson, General Electric Company; "Unattended Distribution Substations of the Commonwealth Edison Company with Remote-Controlled Automatically Regulated 4,000-Volt, 60-Cycle Circuits," H. E. Wulfing, Commonwealth Edison Company; "Alternating-Current and Direct-Current-Controlled Automatic-Feeder Substations," F. E. Goodnow, Public Service Company of Northern Illinois; reports of committees on uniform classification of accounts and customers' records and billing; "Correct Meter Installation and the Use of Protective Devices Against Thieving," R. D. Hart, Central Illinois Light Company; symposium: "Merchandising Domestic Appliances," R. S. Bell, United Appliance Company; "Commercial Appliances," "Convenience Outlets," Electrical Home," representatives of Commonwealth Edison Company.

Best Definitions of Courtesy to Win Prizes

An unusual feature of the convention of the Oklahoma Utilities Association to be held at Oklahoma City on Monday to Wednesday of next week will be the awarding of first and second prizes for the best definitions of "courtesy to the public" from the public utility operator's standpoint. Answers are limited to twenty-five words, and five replies, selected by a committee of three, will be voted on at Wednesday morning's general meeting. E. B. Smith is in charge of the contest.

The electric light division of the association, meeting on Tuesday afternoon, will hear addresses by R. G. Tyler, dean of the Agricultural and Mechanical College, Stillwater, Okla., on "The Relation of the School of Engineering to Utilities;" by B. P. Stockwell of the Oklahoma Corporation Commission on "Commission Regulations Governing Rate Changes," and by W. D. Riggs, Oklahoma Gas & Electric Company, on "Meters and Theft of Energy." Martin J. Insull will address a general session on Monday afternoon on "The Public's Interest in the Public Utilities." On Wednesday to Friday the Southwestern Geographic Division, N.E.L.A., will meet, its Wednesday sessions being held jointly with the Oklahoma Utilities Association. Expected speakers were named in the "Associations and Societies" column last week, page 538.

Additional Hydro Development in Arkansas

The beginning of actual construction work by this month on a hydro-electric development that will have an ultimate capacity of 120,000 hp. is announced by the Caddo River Power & Irrigation Company of Little Rock, Ark. The company has received permission from the Federal Power Commission to construct a dam on the Ouachita River at what is known as the Remmel site, south of Hot Springs. It has already a license covering two other sites, but work is beginning on the dam just authorized. This dam will develop 15,000 hp. at an estimated cost of $2,000,000, and the plant is expected to be in operation in eighteen months.

By a contract with the Arkansas Light & Power Company, the energy from the new development will be distributed largely through the system of that company. The Arkansas Power & Light Company already has a 66,000-volt transmission line from Picron, near Little Rock, to Malvern, connecting with the Malvern-Arkadelphia system. The new plant will be connected with this tie line. The William Crooks Engineering Company has formulated the plans for the development. Ford, Bacon & Davis are consulting engineers. The financing arrangements have been underwritten by a syndicate of western New England and Chicago bankers, according to announcements from the Pine Bluffs headquarters of the Arkansas Power & Light Company.

Brief News Notes

Urbana, Ohio, Has Successful Show.—Urbana, Ohio, with a population of 7,600, closed its first electrical show with such success that the promoters plan to make it an annual affair hereafter. Paid admissions during the two days, Feb. 22 and 23, totaled 2,343.

A Maryland Merger.—The Maryland Public Service Commission has authorized the American Water Works & Electric Company of New York to assume control of the Cumberland Edison Electric Company, which was a recent merger of the old Cumberland Edison Electric Illuminating Company and the Cumberland Electric Company.

University of Colorado to Give Meter Course.—The electrical department of the University of Colorado will, through the electrical standardizing laboratory, furnish a course for metermen in the week of March 19-24. Intensive laboratory work, lectures and round-table discussions will be given. This will be the first time a meter course has been provided at the University of Colorado, but success will lead to its being made a yearly event.

Electrical Alumni Gather at Milwaukee.—Electrical engineers from all over the United States met in Milwaukee on March 1, 2 and 3 to participate in the "homecoming" of the alumni of the College of Electrical Engineering of the School of Engineering of Milwaukee. Bryce Tolbert of Greenwood, S. C., was chairman of the homecoming, and Arthur Richards of Brockport, Pa., was secretary and treasurer.

Scholarships in Electrical Engineering.—Two universities have recently announced the establishment of new scholarships in electrical engineering. Columbia has placed at the disposal of the A. I. E. E. a scholarship in its School of Mines, Engineering and Chemistry which pays $350 for annual tuition fees. Stanford University announces the Elwell scholarship, founded by Cyril F. Elwell, which carries a sti-

pend of $500 in its electrical engineering department.

Flashboard at Neenah Dam, Wis., Ordered Removed.—Efforts are being made by the Wisconsin state government, the Association for Relief of High Water and the water-power interests to agree upon a permanent co-operative plan by which flood conditions may be relieved in the Fox River Valley. The water-power companies are vitally concerned because the Secretary of War has ordered the removal of the flashboard from the Neenah dam and this flashboard is said to effect a saving in fuel to them of $180,000 a year.

Work on St. Croix Development Begun.—The first work by the Northern States Power Company to develop the water power of the upper St. Croix River has just begun. Camps have been built, and a crew of men is making an area survey of the river bottoms, which it is expected will take the greater part of this year. The power dam will be erected at the mouth of Snake River. A large reservoir dam will also be built at the head of the Kettle River rapids.

Federal Court Protects Emergency Rates of Wisconsin-Minnesota Company.—A preliminary injunction restraining the Wisconsin Railroad Commission from interfering with the existing emergency rates of the Wisconsin-Minnesota Light & Power Company has been issued by the United States District Court at Madison. These rates were necessitated by the decision of the Wisconsin Supreme Court annulling the order of the commission which fixed uniform rates on the company's "loop" system and ordering that they be determined for every city on the unit plan. The emergency rates were adopted by the company until the commission can fix permanent rates in accordance with the order of the state court.

Dispute Over Rights on Coosa River.—A storm is brewing in Alabama over the water-power project at Lock No. 2 on the Coosa River. One bank at that point is owned by Roswell Cobb. The other bank belongs to the government. The Alabama Legislature, in which there is some hostility to the Alabama Power Company, is expected to adopt legislation which will extend Cobb's rights. If this legislation is approved, plans are being considered, it is said, whereby the cities of Birmingham and Anniston will attempt to secure rights as municipalities through an arrangement with Cobb. The Alabama Power Company two years ago filed on the site, and it is anticipated that it will not give up its contemplated development without a struggle.

Way Cleared for Large Water-Power Developments in North Carolina.—The bill in the North Carolina Legislature dealing with "eminent domain" and sponsored by the water-power interests has been passed, and the way is now clear for the greater water-power projects to proceed to condemn and fix by court proceedings the price at which lesser water-power developments should be bought. The legislation was thought to be necessary because nuge dams being erected across the rivers were putting smaller dams for long distances up the rivers out of business, and where the parties at interest could not agree on purchase price or damages, development was sometimes blocked. The new law gives power to condemn the affected property and pay assessed price or damages.

United States Supreme Court May Refuse Jurisdiction of Potomac Company Case.—Arguments were presented before the United States Supreme Court Feb. 26 and 27 on the question of the jurisdiction of that court to review the decision of the District of Columbia Court of Appeals reversing and remanding for further proceedings a ruling of the District of Columbia Supreme Court which dismissed an injunction sought by the Potomac Electric Power Company against the District Public Utilities Commission to set aside valuation of the company's property for rate-making purposes. Arguments on the appeal were begun before the Supreme Court on Jan. 24, but were interrupted by Chief Justice Taft, who asked the attorneys to submit briefs on the court's jurisdiction. Attorneys for both the company and the commission argued that the court had jurisdiction, both sides being anxious to have the case passed on by that tribunal.

Associations and Societies

New Section of Institute Organized.—The Southern Virginia Section, A. I. E. E., has been organized at Richmond, Va., with W. C. Bell as chairman and H. C. Leonard as secretary of the executive committee.

Special Libraries Association.—The Special Libraries Association, which is a national organization of all business and special librarians in the country, will hold its fourteenth annual convention in Atlantic City on May 22 to May 25, at the Hotel Chelsea. Librarians, business men, research workers and statisticians are urged to attend.

Sioux City Electrical Club Formed.—About seventy electrical men of Sioux City, Iowa, have formed the Sioux City Electrical Club. The purpose of the club is primarily educational. Membership is open to any one interested in electrical development. C. E. Murphy, superintendent of the Sioux City Service Company, was elected president. Other officers are: E. A. Artz of the Sioux City Electrical Construction Company, vice-president, and Elmer A. Croll, secretary and treasurer.

Engineering Society of Wisconsin.—Meeting at the University of Wisconsin, Madison, on Feb. 22 to Feb. 24, the Engineering Society of Wisconsin went on record as favoring a bill which would create a board of examiners of architects, engineers and land surveyors to consist of the state architect, the state chief engineer, the dean of the engineering college of the university and three engineers in good standing, all to be appointed by the industrial commission. The bill will be presented to the Legislature. Officers elected were: President, John C. White, Madison; vice-president, D. G. Kirchhoffer, Madison; secretary-treasurer, L. S. Smith, Madison.

Coming Section Meetings of A. I. E. E.—March section meetings of the A. I. E. E., in addition to those listed in this column on Feb. 24, are announced as follows: Baltimore, March 18, "Wired Wireless," R. D. Duncan, Jr.; Boston, March 30, "History of Artificial Illumination," M. Luckiesh; Chicago, March 19, "Industrial Research," C. E. Skinner; Cleveland, March 22, "Motors, Bearings, Brakes, Clutches, Control," A. M. MacCutcheon; Minneapolis, March 16, "National and International Standardization," C. E. Skinner; Pittsfield, March 15, "Vacuum Tubes and Their Application," Irving Langmuir; Rochester, March 23, "Relay Protection," Mr. Hunting; Seattle, March 23, "Power-Factor Correction," F. F. Ambuhl; Washington, March 13, "Electrical Equipment on Automotive Vehicles," J. H. Hunt.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 First National Bank Bldg., Oklahoma City.

Southwestern Division, N. E. L. A.—Oklahoma City, March 14-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Illinois State Electric Association—Chicago, March 14-15. R. V. Prather, 305 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

Middle West Division, N. E. L. A.—St. Louis, April 11-12 H. M. Davis, Bankers' Life Bldg., Lincoln.

Tri-State Water and Light Association—Birmingham, April 17-20. W. F. Steiglitz, Columbia, S. C.

American Physical Society—Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

American Institute of Electrical Engineers—Spring convention, Pittsburgh, April 24-26; annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Sept. 25-28. F. L. Hutchinson, 33 West 39th St., New York.

American Electrochemical Society—New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.

American Society of Mechanical Engineers—Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Ohio Electric Light Association—Cedar Point, June 10-13.

Electric Power Club—Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Canadian Electrical Association—Montreal, June 20. Louis Kon, 65 McGill College Ave., Montreal.

American Society for Testing Materials—Atlantic City, June 25-29.

National Council Lighting Fixture Manufacturers—Hot Springs, Va., June 26-28.

Recent Court Decisions

Prior Franchise Gives Exclusive Right to Space Occupied by Lines.—In modifying or interpreting its finding in the inductive interference case of Phillippay vs. Pacific Power & Light Company (ELECTRICAL WORLD, Aug. 12, 1922, page 345, and Jan. 6, 1923, page 56) the Supreme Court of the State of Washington declared that, though the holder of a prior franchise has no exclusive right to the occupation of a street, it does acquire a right, which is in the nature of an exclusive one, to the continued occupation of the space occupied by its poles and wires, subject to proper control by public authorities, and this right must be recognized by the subsequent company in the construction of its line. (211 Pac. 872.)*

Responsibility for Fatality Shared by City and Railroad.—In Carroll vs. Atlantic Coast Line Railroad Company and City of Ozark damages for the death of a pedestrian who came in contact with an electrically charged guy wire were sustained by the Supreme Court of Alabama, which held the defendants equally culpable. The railroad company, which purchased energy from the city plant, had strung a wire on a post to brace which a guy wire and post were maintained by the city, and evidence showed that the lighting wire had become worn and uninsulated for several weeks before the accident and in danger of contact with the guy wire and that the guy post was loose. It was for the jury to decide whether the victim was guilty of contributory negligence in touching or grasping the guy post or guy wire. (94 So. 820.)

Erection of Dam Authorized by Legislature Cannot Be Held a Nuisance.—Charging that the backwater from a dam erected by the Wateree Power Company had formed stagnant pools and provided a breeding place for mosquitoes to the injury of the land and the spread of malaria, the plaintiff in Belton vs. Wateree Power Company obtained damages of $2,000 in the trial court. This verdict has been reversed by the Supreme Court of South Carolina, which holds that an individual not suffering peculiar damages from a nuisance prevalent in the whole community cannot recover, the injury, if any, being a public one. However, the court continued, assuming that the breeding of malaria-bearing mosquitoes is incidental to the construction of a dam authorized by the Legislature, this authorization prevents the dam from being considered as a public nuisance subjecting the company to indictment. In the absence of negligence in the construction of the dam, the only recourse lies in action for compensation. One conveying a part of his land to defendant to be flooded by a dam had impliedly consented to defendant's entry on the land, and even though entitled to recover consequential damages to other lands, if there had been no entry, is limited to an action for compensation under the statute authorizing the construction of the dam. (115 S. E. 587.)

Possibility of Raising Dam No Excuse for Backing Up Water Below Dam.—Harp vs. Iowa Falls Electric Company was an action in equity to enjoin defendant company from maintaining its dam at such a height as to back the water up at plaintiff's dam and mill, and thus destroy or infringe upon plaintiff's right to the fall of the water. The Supreme Court of Iowa, affirming a decree for the plaintiff, held that the possibility that a riparian owner may increase the height of his dam, and therefore obtain the same head of water, does not justify the act of the lower owner in backing up the water on the wheels of the upper owner, especially where the upper owner's statement that his attempt to raise the dam had been objected to by those above him was not denied. Neither did the fact that the owner of a dam could secure enough power to operate his mill with a lesser head by installing more efficient wheels justify the lower owner in the course complained of, since the upper owner is entitled to the intrinsic value of his entire right of fall. The cost to the company of reconstructing its dam was found not so disproportionate to the damage caused to the upper owner as to defeat the right of the latter to an injunction. (191 N. W. 520.)

Indiana Commission Sustained in Indiana Electric Corporation Case.—Sustaining the demurrer of the Indiana Electric Corporation in the suit brought by the cities of Indianapolis and Kokomo against the Public Service Commission, the Indiana Electric Corporation and others to prevent the merger of seven Indiana utility companies, the Supreme Court of Indiana said, among other things, that where the Public Service Commission has jurisdiction and keeps within it, and its action is not vitiated by fraud, its decision of all questions of fact as to value of the properties of public utilities, sufficiency of the income to pay interest and dividends on bonds and stocks authorized, qualifications of a proposed purchaser, and all other questions which it is required to decide as preliminary to taking action in a proposed purchase by a corporation of public utilities, is conclusive upon the courts in a collateral action; that the mere averment that the property is only of the value of $10,300,000, but that the commission, after hearing conflicting evidence as to such value, found it to be worth $17,500,000, does not charge fraud, and that a complaint which does not show by the facts alleged that the Public Service Commission was without jurisdiction nor the order complained of fraudulent is not sufficient to constitute a cause of action. (137 N. E. 705.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Taxing Customers for Extensions.—Holding that a contribution from prospective customers to the cost of extending the lines of the nearest central-station company to Bloomfield was a prerequisite to service, the Utah Public Utilities Commission said: "If the revenue derived from a particular consumer in relation to the special investment made to serve him is not a reasonable amount, then such consumer becomes a burden upon the general consuming public and the service to him constitutes unlawful discrimination. Hence it is that consumers at too great a distance from existing lines or having peculiar conditions of taking service are required to share in the special investment made to serve them."

Location of Service Extensions.—A complaint brought by the C. L. Dooley Company against the Brooklyn Edison Company arose through a dispute over the location of the service entrance on the premises of the complainant, the complainant contending that the defendant should supply the electric service underground, while the Brooklyn Edison Company made the contention that service should be accepted at an existing inlet already on the wall of an inclosed alley or driveway at the complainant's premises. The commission dismissed the complaint, holding that service given to the owner of the premises at one service point through an electric meter properly located is sufficient and that any new electrical construction on the premises should be run to that point.

Original or Reproduction Cost.—In adopting original cost rather than reproduction cost as the measure of value in fixing rates for the Exeter Waterworks, the New Hampshire Public Service Commission said: "Reproduction new values and depreciation values are entirely matters of estimate, and the results obtained depend wholly upon assumptions. An expert will advance convincing arguments why his assumption is correct, and another expert will give equally convincing reasons why *his* assumption is correct, yet the results derived from these assumptions may be and usually are very different. This is not said in derogation of experts, but the fact is that their opinions are of very little help to the commission for the reason that opposing interests can always obtain experts to sustain their side of the case, regardless of how irreconcilable their conclusions may be with the conclusions of the opposing experts. For that reason, if for no other, in fixing values the historical cost of a plant is always more satisfactory than the reproduction cost. One is based upon facts, while the other is based upon estimates which at most are only intelligent guesses."

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

D. H. Foote Third Vice-President of P. G. & E.

D. H. Foote, secretary of the Pacific Gas & Electric Company since 1907, has received the title of third vice-president of the company in addition to that of secretary. Mr. Foote is a native of Philadelphia, and much of his business experience, which was along banking lines, was gained in the position of secretary and treasurer of the Union Trust Company of that city. He went to California in 1901, and upon the organization of the California Gas & Electric Corporation, in 1903, he became its first cashier and assistant secretary. In 1905 the Pacific Gas & Electric Company was organized, and in July, 1907, Mr. Foote was elected to the responsible position of secretary. In 1909 he was elected a member of the board of directors and later was also appointed assistant treasurer.

F. F. Rossman Leaves Westinghouse Company

Frank F. Rossman has resigned as division manager of the Westinghouse Electric & Manufacturing Company at Kansas City to become vice-president and general manager of the Mobile (Ala.) Light & Railroad Company. Mr. Rossman has represented his company in the Kansas City territory for the last eight years and has gained wide esteem and popularity. He had completed his twenty-third year of service with the Westinghouse company and in that time became thoroughly acquainted with railway matters. Friends of Mr. Rossman gave a dinner in his honor at the Hotel Baltimore, Kansas City, on Feb. 22. He assumed the duties of his new office on March 1.

F. A. Bryan, president of the Indiana & Michigan Electric Company of South Bend, Ind., has offered his resignation to the board of directors, to be acted upon at a meeting of the board to be held in New York in April. Mr. Bryan took this action shortly before departing for San Francisco en route to Hawaii, the Philippines, China, Japan and Korea. He will be gone several months. Mr. Bryan has completed twenty-two years of service with the company.

H. E. North, for many years connected with various Byllesby companies, has been transferred from the Oklahoma Gas & Electric Company at Oklahoma City to the Western States Gas & Electric Company at Stockton, Cal. Mr. North was in the stock sales department at Oklahoma City for several years and now takes charge of the Western States Gas & Electric Company's investment department. H. K. Griffin, who has been connected with the electrical industry in California for the last few years, has been appointed commercial agent in charge of new business for the Western States Gas & Electric Company.

Ready Succeeds Sachse on California Commission

Lester S. Ready has been appointed chief engineer of the California Railroad Commission to succeed Richard Sachse, who has resigned to practice as a consulting engineer. The appointment became effective March 1. The new chief engineer has been associated with the Railroad Commission more than nine years, having been assistant chief engineer in charge of the gas and electric department four years. He is a native of Ventura County and a graduate of the University of California College of Electrical Engineering, class of 1912. Since graduation Mr. Ready has been actively engaged in engineering, specializing on public utility regulation. He entered the service of the Railroad Commission of California on Dec. 1, 1913, in the gas and electric division. On Jan. 1, 1918, he became gas and electrical engineer in charge of electric and gas service, rates and valuation. In October, 1919, he was advanced to the position of assistant chief engineer in addition to being in charge of the gas and electric division of the commission, which position he has held since.

L. S. READY

Richard Sachse had been with the commission since 1912 and since 1914 had held the position of chief engineer. He was graduated in civil and structural engineering in 1900 and then was engaged in railway, hydraulic, electric and harbor engineering work in West Africa, Belgium, Germany and Norway and later in the United States. Since 1903 he has been connected in an engineering capacity with the Western Electric Company, United States Steel Corporation, United States Reclamation Service and the Southern Pacific Company. He was recently appointed chairman of the engineering advisory committee to the National Association of Railway and Utilities Commissioners in connection with valuations now being made by the Interstate Commerce Commission. His work as chairman of the inductive interference committee is well known to the electrical industry. After leaving the commission his first work will be a comprehensive investigation of the street-railway situation in Los Angeles with a view to bringing about a unification of the two local systems.

The commission has appointed A. V. Guillou as assistant chief engineer in charge of the gas and electrical division of the commission. Mr. Guillou, who, like Mr. Ready, is a graduate of the University of California College of Electrical Engineering, class of 1912, has acted as assistant engineer in the gas and electric division for the last three years.

Obituary

James Howard Zigler, manager of the lamp sales department of the Westinghouse Electric International Company, died at the Lexington Hospital, New York City, on Friday, Feb. 23, after a short illness, diagnosed by the doctors as sleeping sickness. Mr. Zigler was born in Columbus, Ohio, in 1890, and became associated with the Westinghouse Electric & Manufacturing Company at East Pittsburgh in 1917. Four years later he was transferred to the price department of the Westinghouse Electric International Company with headquarters at New York, and just before his death was made manager of the lamp sales department.

David Augustus Decrow, manager of the waterworks department of the Worthington Pump & Machinery Corporation, died in East Orange, N. J., on Thursday, Feb. 15. Mr. Decrow's association with the company dates back to the early eighties, when he joined the Holly Manufacturing Company as a mechanical draftsman. His promotions were rapid, and in 1903 he was made secretary of the company. Later the Holly Manufacturing Company was combined with the Snow Steam Pump Works at Buffalo as part of the International Steam Pump Company, and Mr. Decrow went to Buffalo to take charge of the pumping machinery. The International Steam Pump Company was succeeded by the Worthington Pump & Machinery Corporation in 1916. Not long after the change Mr. Decrow was called to the head office in New York as manager of the waterworks department, which position he held at the time of his death.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Systematic Selection of Employees

Fundamental Considerations that Should Be Observed in Hiring Help—Studying the Job—Analyzing the Applicant

By Joseph Willits
University of Pennsylvania, Philadelphia

NO BUSINESS organization can be stronger or better or more successful than the individual men and women who are employed in it. The character of the company is the character of the people who represent it. The development and progress of the company cannot advance beyond the capacity of the personnel to grow with it. There is no point, therefore, at which the effectiveness of the whole organization may be so readily influenced as at the point where the selection of employees is made.

There have been many books written about "hiring and firing," and many quack methods have been presented whereby character may be determined and competent service assured by testing the color of the eyes, the thickness of the lips or the bumps on the brow. I have no faith in this. But as the result of a number of years of study, combined with our experience in hiring about six thousand persons for Uncle Sam during the war, I have the greatest faith in the systematic selection of employees by the practical exercise of ordinary care and common sense and scientific methods. And there are certain fundamentals of such intelligent selection that may be readily classified and easily applied.

System Needed in Hiring

In the first place, for any industry and any organization, employment should be centralized so that those who do the hiring for the company may become expert in it. By this I mean not only expert in the judgment of character but skilled in the judgment of the job as well and in the maintenance of the standards and policies of the house. For when the hiring is left to each department head to choose his own assistants it is done in odds and ends of time by any method that suits him, and the result is a hit-or-miss policy with no governing purpose nor central control. To hire intelligently requires a very systematic process of adaptation and proficiency and can only be attained through experience and aptitude.

Before all else, it must be known what kind of an employee is needed for the job in prospect, and in order to be sure a careful detailed statement of the qualities desired should be drawn up. This statement should be prepared by the person who is to do the hiring, for it forces him out into the factory or the department to learn the labor problem and it helps him to give the applicant a clear idea of the job. It avoids either overselling or underselling the job, which would become a source of unrest. For too often the desire in the part of eagerness to fill the position leads to the painting of a too rosy picture.

The statement mentioned above should embrace:

1. A careful description of the work; the job that leads to it and the job that it leads to; responsibility, permanence, pay, hours, overtime; whether it requires an alert or a placid person; operations, machines, tools, postures, speed, disagreeable features, causes of common objection, sources of supply.

2. Description of the employee wanted; sex, race and nationality, language, education, physical and personal qualities, age limits.

To draw up such a specification requires a close study and contact with the work of the organization and intelligent knowledge of the personnel. The man who hires must know not only the kind of an employee who is needed and what kind of a job must be filled, but where the man or woman for the job can be found. He must be in a position also to guide in the training of men for promotion, for it is far better to find material within the organization, if possible, on account of the influence it exerts on ambition and slackness. But he must also know the outside sources of labor. He must have his work organized so that he may maintain a "prospect" file. He should receive his acquisitions sufficiently in advance to have time to draw from his classified "prospects" and not merely "hire at the gate." This also gives the person hired time to consider the job and give proper notice to the employer for whom he is working.

Four Practical Tests

The person who does the hiring must be approachable, sympathetic and a judge of human nature. He must have maturity, education and experience in the industry. He must have a place provided so that the interview may be held in private. He must proceed with the examination of each prospective employee with systematic thought and thoroughness, testing the applicant in accordance with the nature of the job to be filled. There are four tests that can be applied in the classifying of prospective employees and adapting them to jobs that must be filled. They are:

1. Health test. Its purpose is not to eliminate but to guide and aid employment by setting applicants into four classes: (a) Health all right for any job; (b) health right for some definite class of work; (c) health adequate for certain work, but needs attention as to throat, heart, etc.; (d) a small group with health dangerous to other members of organization.

2. Trade test — of limited use, where trade information is a factor in the job. It serves to sort out novices, apprentices, journeymen, experts.

3. Mental test—for alertness, intelligence, character.

4. Physical test — to determine special ability and fitness, speed, alertness, strength, endurance, sight, hearing, nerve poise.

Such tests, however, should be used only to assist the judgment of the hirer, for systematic, painstaking common sense and thoroughness must be the foundation of it all. Intelligent discrimination comes out of experience, and in any organization it pays to take the job of hiring seriously enough to approach it in this way and make it a chief function of the one best fitted in the organization to do that work. The degree to which the physical and mental tests may be carried depends somewhat on the size of the organization and the amount which can be expended on expert assistance for the employment official.

The principle of intelligent selection, however, may be applied in any case in any business and deserves more attention than it usually receives.

That this applies as well in the electrical industry as elsewhere is evidenced by a recent statement by J. W. Bancker, assistant vice-president of the Western Electric Company, Chicago. He said:

> During the past few years the application of scientific analysis to the problem of industrial management has occupied the attention of many companies. This analysis has been largely directed to the solution of the problem as it was affected by the factors of materials, processes and equipment, and while it has been recognized that the study of the human element is at least as important as the other elements involved, comparatively little analysis of this factor has been attempted in comparison with the thought and study directed to the others.*

*_Annals_, American Academy of Political and Social Science, May, 1916.

The Matter with Bill Jones, Contractor

A Little Close-up of the Man on Whom the Electrical Industry Is Waiting to Develop the Market for Electrical Appliances— What the Manufacturer and the Jobber Must Do

BY J. EUGENE CHRISMAN
Dallas, Tex.

THERE is a good deal the matter with Bill as a retailer of electrical appliances, but only part of it is his fault. Most of it is the fault of the industry he is connected with. If Bill Jones is asleep on the job, what of the jobbers and the manufacturers that serve his territory?

If Bill Jones has eleven "Sloshwell" washers collecting dust in his warehouse, whose fault is it? What sold them to Bill? Not the fact that he needed washing machines. Not much. The thing that sold those washers to Bill was the fact that the "Sloshwell's" so-called "dealer helps" looked as though they would produce results and move the goods. Bill may not be a merchandiser, but he knows that the profit on washing machines, so far as he is concerned, begins only when they are out in homes washing clothes.

"CAMPAIGN" EXPERIENCE

Bill did have the agency for a good vacuum cleaner too. One day he received a letter stating that if Bill felt that a good live vacuum-cleaner campaign would help in his town, the manufacturers would be glad to send a crew of trained salesmen to conduct such a campaign through his store. Bill bit! In due course of time the "crew" arrived. The company sent a letter to most of Bill's customers stating that "they had been selected by the Jones Electric Shop" for a free demonstration and trial of the cleaner Most of the folks in Centerdale, knowing Bill to be on the square and feeling that he was behind the campaign, accepted the free trial. The crew stayed two weeks and "sold" sixty-one cleaners. The first week one of the salesmen jumped his board bill and departed between days, bringing down the wrath of the widow Elkins upon Bill's innocent head. A week after the departure of the crew numerous customers who had "bought" cleaners began calling Bill on the phone. It developed that most of the "sold" machines had been merely left with the customer on the pretence of a thirty days' trial and no money paid down. They had signed monthly-payment agreements on this pretext, which had been turned in to the company as a bona fide sales, the "crew" having been engaged in a prize contest and each out to win. Bill suffered in silence, vowing never again!

What Bill Jones needs is real factory and jobber co-operation. Instead of gaudy window displays that are never displayed and broadsides that are never broadcasted, he needs selling campaigns that sell goods, Bill Jones must be sold the idea that if he wants business he must go after it and then be shown how to do it. Bill Jones needs resale assistance that will involve the personal aid and guidance of trained factory resale men, on the ground and not in an envelope.

Will it pay to put a man on the ground to show Bill Jones how to sell? Decidedly yes! Within a distance of 10 miles from Bill's store, waiting for good selling methods to gobble it up, lies approximately $20,000 worth of vacuum cleaner business alone. There is possibly $30,000 worth of small appliance business to be written on irons, heaters, percolators, toasters and fans alone! It is surely worth the time of any washing-machine manufacturer or jobber to begin working on the fifty-thousand-dollar washing machine market in his territory. In addition to this there should be not less than $20,000 on ironers and $10,000 on dishwashers, considering only the better class of homes as prospects for these appliances.

KEY LOG IN THE JAM

Jobbers and manufacturers are asking daily, "What's the matter with Bill Jones?" Bill Jones is all right. He's waiting—waiting for some one to come along and show him how to do it. He's waiting for some one to show him that he's sitting on a gold mine. He is all set to go. He is established in his town. Everybody knows Bill; he's been square with them; their children go to school with his; he belongs to the same lodge as most of them. Of course, if Bill had the enterprise he should have, he would undoubtedly have figured out a way to take advantage of this gold mine of his by himself. It's really too bad that he hasn't done it, for it would have saved the electrical industry a lot of trouble, but since Bill is just Bill there's no use lamenting the fact. The thing to do is wake him up.

The big problem not only of the electrical business but of every other business is turnover. In the electrical industry the problem starts with Bill Jones and goes right on up through the jobber's establishment and into the factory. Bill Jones is the key log in the jam. Show Bill how to move goods and you break the jam that holds back profits and production. Its regrettable that Bill has to be educated into an electrical merchandiser; he should do it for himself. But he doesn't.

Let's educate him to the fact that if he wants business he must go after it. Let's educate him to the fact that the home and not the display room is the place to sell appliances. Let's educate him to the fact that no new home should go up in his city without him being on the ground to figure on modern wiring and fixtures and a complete equipment of household appliances. Let's show him why a home builder, putting up a home at a cost of, say, $8,000, can be sold $500 worth of appliances before the house is erected, making it $8,500, easier than he can after he's moved in.

Let's show him how to keep card files that keep him posted on the electrical needs of his territory. Let's show him how to use any one appliance as an entering wedge and how to follow up on it until he's sold full equipment. Let's show him how to put on and train a couple of outside house-to-house men and let's help him train them. Let's instill into Bill Jones the "Sell 'em something more" idea. Let's realize that a dozen washers, cleaners or percolators gathering dust in Bill's store mean no more washers, cleaners or percolators on the jobber's salesman's order blank until those dozen are out in homes on duty and Bill is reaping the profit from them.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

Manufacture of Fixtures Gained 29 per Cent in Seven Years

The Department of Commerce on March 2 announced that, according to reports made to the Bureau of Census, the value of products of establishments engaged primarily in the manufacture of gas and electric fixtures amounted to $42,890,000 in 1921, as compared with $42,268,000 in 1919 and $28,740,000 in 1914. This shows an increase of 1 per cent from the year 1921 and an increase of 29 per cent for the seven-year period from 1914 to 1921.

This industry includes establishments manufacturing, as their products of chief value, gas fixtures, chandeliers, domes, burners, mantles, etc., and electric fixtures, holders, electroliers, brackets, portables, etc. Of the 308 establishments reporting products valued at $5,000 and over in 1921, 97 were located in New York, 41 in Pennsylvania, 31 in Illinois, 25 in Ohio, 24 in California, 13 in Wisconsin, 11 in New Jersey, 8 each in Michigan and Minnesota, 7 each in Connecticut and Washington, 6 in Missouri, 5 each in Maryland, Massachusetts and Tennessee, 3 each in Indiana, Iowa and Oregon, 1 each in Colorado, Kansas, Kentucky, Nebraska, Oklahoma and Rhode Island.

In December, the month of maximum employment, 10,680 wage earners were reported, and in August, the month of minimum employment, 8,787—the minimum representing 82 per cent of the maximum. The average number employed during the year was 9,419 as compared with 9,795 in 1919 and 10,913 in 1914.

The statistics for 1921, 1919, and 1914 are summarized in the table.

DATA ON MANUFACTURE OF FIXTURES—ELECTRIC AND GAS

	1921*	1919*	1914*
Number of establishments	308	319	389
Persons engaged	11,735	12,379	13,649
Proprietors and firm members	203	221	320
Salaried employees	2,113	2,363	2,416
Wage earners (average number)	9,419	9,795	10,913
Salaries and wages	$15,479,000	$14,292,000	$9,852,000
Salaries	4,419,000	4,490,000	3,348,000
Wages	11,060,000	9,802,000	6,504,000
Paid for contract work	41,000	65,000	67,000
Cost of materials	18,788,000	20,259,000	14,090,000
Value of products	42,890,000	42,268,000	28,740,000
Value added by manufacture†	24,102,000	22,009,000	14,650,000

*Statistics for establishments with products valued at less than $5,000 are not included in the figures for 1921. There were twenty-nine establishments of this class, reporting twenty-three wage earners and products valued at $77,000. For 1919, however, data for twenty-two establishments of this class, reporting sixteen wage earners and products valued at $59,000, and for 1914 data for seventy-one such establishments, with eighty-two wage earners and products to the value of $200,000, are included in all items with the exception of "number of establishments."

†Value of products less cost of materials.

Denver Radio Equipment Sales Improving

Radio activities in Denver have been materially stimulated after the announcement that a new broadcasting station, backed by the leading radio jobbers and dealers in that city, will soon be put in operation. Although radio equipment has been moving well in the Denver territory for some time, a recent report indicates that improved broadcasting facilities are badly needed. Higher-priced sets are moving in good number in the Rocky Mountain territory. Crystal sets and cheap parts for home assembly are not so much in demand as they were last fall. Stocks, both jobbers' and dealers', are complete, and since the holidays there has been a marked standardization. Business in the radio departments of dry-goods and stores other than specialty or electrical shops has decreased.

Active Demand for Wire in Many Types

Continued expansion of the electrical industry is throwing an immense amount of business upon wire manufacturers and jobbers, well ahead of the increased seasonal demand anticipated, as open weather permits the acceleration of construction work. All winter the sale of rubber-covered wire has been active, and the increased amount of building construction reported from many parts of the country has been a major factor in keeping the wire plants on full time. During the past few weeks a large amount of weatherproof wire has also been purchased, and in some sections the growth of interconnection and the insatiable demand of consumers for central-station service have resulted in heavy shipments from jobbers' stocks and from the manufacturing plants into the field. More life has appeared in the bare-wire market as a result of these interconnection programs, New England in particular having committed itself to a vigorous development in this field.

Consumption Increasing Rapidly

For months the reports of the business statisticians have marked substantial gains over contractual totals of a year ago, and both old and new building wiring jobs are demanding great quantities of wire. Campaigns for increased outlets are of some importance in this trade as well as the never-ending call of betterment jobs in industrial and mercantile establishments. Enormous increases in wire sales for telephone work are being noted, including the extension of toll cable facilities, some of which with auxiliary apparatus represent an investment of $35,000 per mile.

Advances in copper and cotton prices have lately been reflected in wire, and a good proportion of the business of the past month has been stimulated for early delivery by the anticipated stiffening of quotations as the prices of these basic commodities have risen. Notwithstanding the large volume of business being done, competition continues acute in the wire market. The delivery situation is aided somewhat by the production of wire in various localities, with the maintenance of supply by motor trucking in cases where railroad congestion is blockading freight movement. Considerable reliance is placed on boat

shipments in the Atlantic Coast market, and the outlook is much better along transportation lines than it was a few weeks ago. There seems little doubt that the year's business will be in most satisfactory volume, for the demand for wire for use in machinery, appliances, radio equipment and in miscellaneous applications is increasing, as are also the requirements of interior and outdoor service.

The Metal Market

Copper Advanced to 16.75 Cents—Sales Smaller—Discourage Reckless Buying—Export Demand Better

The daily advance in copper prices continued until now 16.75 cents, delivered, has been reached, this figure being generally quoted by producers at the week end. Two or three producers have not yet come to that level. Sales have not been quite so great as last week, but this has been more because producers have been inclined to discourage reckless buying rather than due to any lack of inquiry. A particularly encouraging feature of the week has been a good export demand, which has made some producers care little about booking further domestic orders. Some of the export business has been for the Orient.

NEW YORK METAL MARKET PRICES

Copper	Feb. 27, 1923 Cents per Pound	Mar. 7, 1923 Cents per Pound
Electrolytic	16.37½	16.75
Lead, Am. S. & R. price	8.00	8.10
Antimony	7.50	7.62½
Nickel, ingot	30.00	30.00
Zinc, spot	7.20	7.30
Tin Straits	43.12½	42.00
Aluminum, 98 to 99 per cent.	24.00	24.00

Meter Sales Are Gaining with Well-Maintained Deliveries

Improved demand for meters is a marked feature of the present manufacturing situation, and thus far, with the exception of some special equipment, deliveries are being well maintained. The expansion of the building industry and widespread development of house-wiring and outlet campaigns is being reflected in the production of representative manufacturers. Shipments are prompt on the more common lines and types. As a result of anticipating this business, conditions are reasonably good with respect to the supply of raw materials, and thus far the advancing prices noted in copper and cotton have not been reflected in quotations for meters.

In well-informed circles the opportunities for a larger development of industrial meter business are receiving some consideration, especially in connection with the rapid development of central-station service in industry and the possibilities of attaining higher manufacturing efficiency through more accurate studies of departmental operations and the derivation of more data as to energy consumption per unit of product in different portions of industrial establishments. Considerable "missionary work" will have to be done here before the business makes any great impression upon the trade.

CHICAGO TRADE BRISK

Increasing demands for electrical services in Chicago, coupled with new building construction, are improving the market for watt-hour meters. This situation also appears to be universal in the Middle Western territory radiating from Chicago. With the increase of 73,321 new customers on the Commonwealth Edison Company lines during the year, each requiring a new meter, some indication can be given as to the number of meters needed in this territory. Jobbers' supplies are in good condition and prices remain firm. The Public Service Company of northern Illinois had a customer increase during 1922 of 20,938.

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

STEADY progress is reported for the electrical market during the week just ended. Conduit stocks in the New York and Massachusetts territories are improving despite poor transportation caused by snow and rain in the interior states. An active call for meters, poles and wire by the utilities is noted. Lamps are said to be selling in greater volume. Appliance sales are slower than two weeks ago.

Boston General business is gaining momentum and the electrical industry is intensely active. Buying for stock is still being done conservatively, although the hardening of prices in basic commodities has stimulated orders sharply for the time being. The arrival of delayed shipments of conduit has relieved the scarcity in this line to a considerable extent. Shortages still exist in radio tubes, and poles are still scarce on account of bad road conditions in the interior. Business is greatly hampered by delays in mail service, notably between New York and Boston. Labor is very widely employed. The textile and leather industries are extremely busy and retail trade is developing steadily. Building contracts in New England totaled $2,933,700 for the week ended Feb. 27, against $1,565,800 for a year ago.

New York Business in the electrical market continues at a steady gait with some falling off in the demand for appliances and radio. Commodities which have taken on added interest during the last few days are meters, motors and lamps. Conduit stocks are reported to be slightly improved with rather higher prices noticed in the wire lines. Construction projects are progressing fairly well, and the demand for all electrical materials entering into new buildings is expected to pick up to the highest strength of last year at from two to three months earlier. Collections are reported to be only fair.

Baltimore The transportation situation has hindered deliveries along certain lines, causing a falling off in stock for some of the jobbers, although not to any detriment to business, owing to the fact that most jobbers are well stocked in all lines. There has been a more steady demand for motors, especially in the larger sizes. There is an expected activity in wire due to the increase in the price of copper. The exceedingly warm spell which is breaking all heat records for this period in the year for this section has completely demoralized the market for all heating apparatus. Commercial fixtures and lamps have been holding their own, and there is a fair demand for cable.

Atlanta Electrical jobbers report very satisfactory sales in the 5-amp. and 10-amp. two-wire and three-wire meters, small residential and commercial construction having acted as quite a stimulus to sales. Jobbers' stocks are in good shape, with the exception of the large and high-tension types. Wire continues to move briskly, despite continued price advances, and local stocks of the more popular sizes are somewhat depleted. Shipments from factory on the larger sizes are becoming longer. Electric range sales are satisfactory, and one jobber expressed the opinion that his sales this year will be at least 100 per cent in excess of those last year. Stocks are satisfactory and prices generally firm.

Pittsburgh The general tendency is for increased business in all lines. There was a specially good business report during the week on electrical appliances. One jobber reported as having received an order for ranges for a large apartment dwelling now being constructed. Increased business was reported by the jobbers from the industrials, this being of greater volume than ever before. It is quite noticeable that these orders are for new material rather than for piece parts as in the past. During the week new agreements were signed by practically all building crafts in this territory, which means that labor troubles will be averted during 1923 and a portion of 1924. Central stations are showing a marked activity in the way of taking over new territory.

Demand, Supply and Price Trend of Nineteen Commodities as Sold in Sixteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week
Reports will include
Conduit Boxes, Signal Apparatus and Rectifiers

	Wire	Armored Cable	Conduit	Transformers	Poles	Pole Line Hardware	Porcelain	High Tension Equipment	Fuses	Meters	Switches	Wiring Devices	Lamps	Commercial Fixtures	Motors	Radio	Instruments	Electric Ranges	Hollow Ware
Boston																			
Demand	Act.	Sdy.	Act.	Sdy.	Slow	Sdy.	Act	Act.	Sdy.	Sdy.	Act.	Sdy.	Act.	Act.	Act.	Act.	Sdy.	Act.	Sdy.
Supply	Nml.	Nml.	Nml.	Nml.	Low	Low	Low	Low	Hi.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Low	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Dec.	Firm	Firm	Firm
New York																			
Demand	Act.	Act.	Sdy.	Sdy.	Slow	Sdy.	Sdy.	Act.	Act.	Act.	Act.	Act.	Act	Sdy.	Act.	Act.	Sdy.	Act.	Sdy.
Supply	Nml.	Hi.	Low	Nml.	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Low	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Inc.	Inc.	Firm	Firm	Firm	Dec.	Firm	Firm	Firm
Baltimore																			
Demand	Act.	Slow	Act.	Sdy.	Slow	Slow	Sdy.	Slow	Act.	Slow	Act.	Act.	Act.	Slow	Sdy.	Sdy.	Sdy.	Slow	Sdy.
Supply	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Low	Nml.	Nml.	Nml.	Low	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Atlanta																			
Demand	Act.	Act.	Act.	Sdy.	Act.	Act.	Act.	Slow	Act.	Act.	Act.	Act.	Act.	Act.	Sdy.	Act.	Sdy.	Act.	Slow
Supply	Low	Nml.	Low	Nml.	Low	Nml.	Nml.	Low	Nml.	Nml.	Low	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Low
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm
Pittsburgh																			
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Act.
Supply	Low	Nml.	Low	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Cleveland																			
Demand	Act.	Act.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Sdy.	Act.	Sdy.	Act.	Sdy.	Act.	Sdy.
Supply	Nml.	Low	Low	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Chicago																			
Demand	Act.	Sdy.	Act.	Sdy	Act.	Slow	Slow	Act.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Act.	Act.	Sdy.	Sdy.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Firm
St. Paul-Minneap.																			
Demand	Act.	Slow	Sdy.	Sdy.	Act.	Slow	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Slow	Act.	Sdy.	Slow	Slow
Supply	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
St. Louis																			
Demand	Act.	Sdy.	Act.	Sdy.	Slow	Sdy.	Sdy.	Act.	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Sdy.	Slow	Slow
Supply	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.
Price trend	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
New Orleans																			
Demand	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Slow	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Sdy.	Act.	Sdy.	Slow	Slow
Supply	Low	Nml.	Low	Nml.	Low	Low	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Denver																			
Demand	Act.	Act.	Act.	Slow	Act.	Act.	Sdy.	Slow	Act.	Slow	Sdy.	Act.	Sdy.	Act.	Slow	Act.	Sdy.	Slow	Sdy.
Supply	Nml.	Low	Low	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Salt Lake City																			
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Slow	Act.	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Slow	Sdy.	Slow	Sdy.	Sdy.
Supply	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Hi.	Nml.	Nml.	Nml.	Hi.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm
Portland-Seattle																			
Demand	Act.	Act.	Act.	Act.	Act.	Act.	Slow	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Act.	Slow	Sdy.	Slow
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Inc.	Fir m	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Inc	Firm	Firm	Firm	Firm	Firm	Firm	Firm
San Francisco																			
Demand	Act.	Act.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Sdy.	Act.	Slow	Sdy.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.
Price trend	Inc.	Inc.	Firm	Firm	Firm	Dec.	Dec.	Firm	Inc.	Firm	Inc.	Inc	Firm	Dec.	Firm	Firm	Inc.	Firm	Firm

Cleveland Dealers as well as manufacturers and jobbers enjoyed a very satisfactory week. Improvement in industrial equipment is evident. Wire, conduit and copper stocks are extremely low and demand constantly increasing. Prices of these commodities are advancing rapidly in consequence, while deliveries are hampered by poor transportation. Poles, porcelain and hardware are recovering gradually but with firm prices. Appliance sales are in greater volume, with active interest in heaters and ranges, due to the gas controversy and cooler weather. Radio equipment is in fair demand, and the tube shortage has been relieved somewhat. Meters are in better demand and central-station business is most promising. Building operations are handicapped slightly by labor difficulties, but plans are under way to assure an active spring. Fixtures are moving well and collections are in good shape.

Chicago Electrical business, according to jobbers and manufacturers, is steadily forging ahead. Building construction requires an increasing amount of wire and wiring materials, although prices on these commodities are gradually strengthening. Demand on commercial fixtures is also active. The call for motors is up to the previous sales rate, but shipments from manufacturers are slowing up. The porcelain market is a little irregular, since manufacturers are somewhat pressed for raw material.

St. Paul-Minneapolis All steel products are on the rise. Stocks are getting low on all kinds of wire. Demand from the country is still active for all lines. Retail business is dragging. Appliances are slow, but wiring is fairly active. Jobbers expect a lull for about three weeks for all lines.

St. Louis An increase of approximately 40 per cent is reported in the sale of electrical supplies during the past month over the same period a year ago. This is attibuted to the general improvement in business, almost uninterrupted building operations during the winter and heavy buying by the public utility companies.

Orders for automobile equipment have also aided in swelling the sales for this month. There is an excellent demand for small motors for household appliances, and more than the usual seasonal volume of contract work for wiring is reported. Electrical equipment for mining work and for the oil fields is moving well. The consumption of electrical energy for industrial purposes shows an increase of almost 70 per cent over the same month last year.

Denver Cold weather is holding back outside construction. Improved broadcasting programs have stimulated both interest and trade in radio. Electric commercial vehicles are again developing interest in this territory after a decade of inactivity. Steel mills are working at capacity and coal shipments are moving easily. Business is good and the electrical industry is profiting, but not in the degree it should if conditions through the territory were more stabilized.

New Orleans The feature of the market is the continued and steady rise in the price in wire, the largest item in electrical installation. Wire is now about 25 per cent higher than it was last year, and the copper, rubber and cotton markets indicate further increases. The market for ranges is increasing.

Salt Lake City The real-estate market is showing improvement, particularly in the larger towns and cities. Homes are in fair demand, and the 1923 cottage construction program promises to be on a par with that of 1922. The month of March opened with bonds showing strength and mining stocks in a much improved condition. A more pretentious live-stock show will be staged in April than has been held in several years past, a fact indicating marked improvement in that important Intermountain industry.

San Francisco Building is brisk, averaging about a 15 per cent increase over last year. Retail business is good, department stores especially reporting excellent business as compared with 1920. The recent San Francisco automobile show gave good indication of increasing buying power in its attendance and immediate sales. Labor conditions continue excellent, and non-employment is virtually confined to unskilled laborers. Conduit demand is active after a 5 per cent increase. Stocks are far below normal. Construction demand is steady. Power company crews report progress in apartment-house sales. The popularity of white-enameled ranges has necessitated local stocks of several makes. Percolator sets, in urn patterns, and waffle irons are especially popular. Silver-finish sets are increasing slightly in demand, but the real call is for nickel sets listing from $30 to $40. Col'.ctions are improving.

Portland-Seattle Business conditions continue to hold up in good shape. The value of building permits for the first two months of this year is materially in excess of that of a year ago, and the same condition applies to electrical permits. Conduit stocks are still in a precarious condition with a sustained active demand, slow deliveries and short stocks. Manufacturers are no longer quoting prices in advance and jobbers' orders are placed subject to price at time of shipment. Another advance in the base price of copper is reported for the past week. Weatherproof wire followed the rise, but rubber-covered has not yet been affected.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Gain in Allis-Chalmers Orders

Orders on the books of the Allis-Chalmers Company, Milwaukee, on Feb. 1 amounted to $9,000,000, compared with $8,400,000 on Jan. 1. Officials of the company estimated that the total on March 1 would be at least $9,500,000. The lead in incoming orders has been taken by the electrical cement machinery and turbine departments.

Westinghouse Electric Rents Half of Proposed Skyscraper

The Westinghouse Electric & Manufacturing Company last week leased for a period of ten years twelve floors in the new twenty-three story bank and office building to be erected at 150 Broadway, New York City, by the 150 Broadway Corporation. The building will be known as the Westinghouse Building. The space leased by the Westinghouse company comprises between 90,000 sq.ft. and 95,000 sq.ft., and the amount of money involved in the lease is in excess of $3,000,000.

The Westinghouse lease is for all the floor space from the twelfth floor to the twenty-third floor, inclusive. Co-tenants with the Westinghouse Electric & Manufacturing Company will be the Westinghouse International Company, the Westinghouse Lamp Company and the Westinghouse Air Brake Company. It is expected that considerably more available office space in the building will be leased to companies allied with the Westinghouse company's business. The offices of the Westinghouse Electric & Manufacturing Company are now at 165 Broadway.

Electric Power Equipment Firm Arranges Agency in Seattle

The Electric Power Equipment Corporation, Fifteenth and Wood Streets, Philadelphia, announces that it has arranged an agency in Seattle, Wash., with Eicher & Bragg, 2107 L. C. Smith Building. This agency will cover the states of Washington and Oregon. This agency is handling, in addition to the line made by the Electric Power Equipment Corporation, equipment of the Kelman Electric & Manufacturing Company, Pittsburgh Transformer Company, Pittsburgh Electric Furnace Corporation, Jewell Electric Instrument Company and the Stromberg lines.

To Manufacture and Repair Transformers in Newark

D. J. Norton, formerly of the General Electric Company's Pittsfield works and for the past seventeen years superintendent of the American Transformer Company, Newark, N. J., has opened a manufacturing plant at 71 Hamilton Street, Newark, specializing in manufacturing and repairing of transformers. Special attention will be given to engineers having their own designs, and estimates will be furnished on request.

Rome Wire Plans Addition

The Rome Wire Company, Rome, N. Y., manufacturer of electrical wires and cables, will build a one-story addition to its branch plant on Clyde Avenue, Buffalo, to be 33 ft. x 300 ft. and estimated to cost about $42,000. It will be used for general increase in production. The contract for the work has been awarded to the John W. Cowper Company, Fidelity Building, Buffalo.

Apex Representatives Meet

Fifty Southern representatives of the Apex Electrical Distributing Company, including state and branch managers and salesmen of the company, attended the annual Southern district sales convention in Atlanta on March 3. The principal speakers were R. J. Strittmatter, sales manager of the company, Cleveland, and R. H. Short, Southern district sales manager, Atlanta.

Buffalo Fuse Corporation Plans Sales Expansion

Rapid sales expansion is planned by the Buffalo Fuse Corporation, 72 Main Street, Buffalo, which a year ago took over the manufacturing of the renewable electric fuse formerly made by the Pierce Fuse Corporation. The company has just amended its incorporation to provide for $50,000 preferred stock in addition to its 2,000 shares of common. The new board follows: Robert F.

Bickford, president; W. S. Harrison, vice-president; John G. Clemens, secretary, and Lambert G. Smith and Harvey B. Harrison, additional directors.

Northwest Electric Changes Name

The Independent Electric Company is the new name of the Northwest Electric Apparatus Company, Security Building, Minneapolis. The reason for this change was that the company was sometimes confused with other companies and also that it was representing independent manufacturers in the capacity of manufacturers' agent.

P. A. Geier Announces Spring Housecleaning Sales Contest

A spring housecleaning sales contest, which will run from April 2 to June 2, has just been announced by the P. A. Geier Company, Cleveland, manufacturer of the "Royal" cleaner. This contest is open to retail salesmen, cash or merchandise prizes being awarded not only to the leaders, but to all who qualify with a reasonable number of sales.

Previous contests conducted by this manufacturer have proved very successful in stimulating selling activity during seasons which are normally considered dull. The present competition, held during the period of heaviest demand, is expected to give exceptional results.

To Handle Anaconda Sales

A new organization, to be known as the Metals Sales Corporation, will be formed to handle the sales of copper of the Anaconda Copper Mining Company. This business heretofore has been handled by the United States Metals Selling Company, which in the future will handle the sales of lead, zinc and other metals other than copper.

The new organization will take over all liabilities of the United States Metals Selling Company involving the sales of copper. It is expected to be the second largest organization of its kind in existence, and if later it should handle the sales of copper produced by the Chile Copper Company, now controlled by Anaconda, it is expected to hold first rank in the metal-selling business.

Uehling Instrument Appoints Agents in Japan and China

Mitsui & Company have just been appointed exclusive representatives in Japan and China for Uehling CO_2 recording equipment and other Uehling power-plant instruments and gages. The head office of Mitsui & Company is in Tokio, and the New York branch office of the company is located at 65 Broadway.

The main office and factory of the Uehling Instrument Company is in Paterson, N. J. Many Uehling installations have been made in Japan and China without the aid of local representatives, but it is believed that with the co-operation of the engineering department of Mitsui & Company the Japanese and Chinese Uehling customers will be served to advantage.

Benjamin Electric Appointments

The Benjamin Electric Manufacturing Company, Baltimore, has announced that Merritt L. Tice, district sales representative, will soon take on added territory in North and South Carolina, Georgia, Florida and parts of Tennessee and Alabama. Additional men will be put into the district and the territory more intensively served.

Thomas F. McDonough is now in charge of the Northwest territory of the Benjamin Electric Manufacturing Company, consisting of Montana, Idaho, Washington and Oregon, with headquarters in the L. C. Smith Building, Seattle. The company also announces that Carl O. Martin, formerly in charge of the Northwest sales territory, has been transferred to a larger field, with headquarters in San Francisco. He will serve in that city as assistant to Miles S. Steel, Pacific Coast manager.

The Century Electric Company, manufacturer of single and polyphase motors, St. Louis, has opened an office at 603 Queen and Crescent Building, New Orleans, where a complete stock of motors will be carried.

The Union Electric Manufacturing Company, South Bend, Ind., of which Fred. A. Bryan is president, has recently been absorbed by the Indiana & Michigan Electric Company by the purchase of stock by the latter company. No change in management will occur, it is said. Hugh McVicker will continue as manager and Joseph Black as superintendent.

The Sunlight Lamp Company, which has been operating in Warren, Ohio, under the name of the Sunlight Electric Company, has moved to Newton Falls, Ohio, having acquired the building formerly occupied by the Newton Manufacturing Company.

The Weldon Manufacturing Company, Detroit, electrical specialties, will establish a plant at Grand Rapids, having purchased a site at Russell Avenue and the Père Marquette Railroad. It is announced that contracts have been let for a factory, 50 ft. x 125 ft.

The Gibb Instrument Company, Bay City, Mich., manufacturer of welding equipment, has increased its authorized capital stock from $75,000 to $175,000. Of the increase, $40,000 has been sold at par value to provide increased manufacturing facilities and to take care of increasing business.

The Cornell-Mathews Company, sales engineers, Christ Building, Orlando, Fla., announces the closing of a contract with the Orlando Utilities Commission for all-steel switching and distribution towers equipped with air brakes, switching apparatus and choke coils. The structures are 50 ft. long and 40 ft. high and contain 48,000 lb. of structural steel. The entire output of the new generating station for Orlando will be carried underground in cable and distributed from the switching towers described above. The Cornell-Mathews firm is district agent for the Delta Star Electric Company, Chicago.

The American Electrical Supply Company, 953 Washington Boulevard, Chicago, on March 1 moved into a new building at 117 South Morgan Street. C. E. Browne is president of the company.

The Art Craft Fixture Company, 85 Academy Street, Newark, N. J., manufacturer of lighting fixtures, has acquired a factory at Adams, Malvern and Delancey Streets for a new plant. The present works will be removed to this location and additional machinery installed, according to officials of the company.

The E. H. Freeman Electric Company, Meade and Prince Streets, Trenton, N. J., is arranging for the installation of equipment and operation of its three-story addition, 35 ft. x 164 ft., now being completed for the manufacture of electrical equipment.

The Holland Maid Company, Holland, Mich., has been organized with a capital of $400,000 to take over the plant of the Holland Manufacturing Company, manufacturer of electric washing machines and clocks.

The Am-Plus Storage Battery Company, formerly at 741 Van Buren Street, Chicago, has leased the third floor, 100 ft. x 100 ft., of the building at 449 West Superior Street.

Carman & Fryer, Indianapolis, operating an electrical contracting business, have acquired the electrical repair department of the Vonnegut Machine Company, with local works and will operate it in the near future. The works will be extended and additional equipment installed, according to officials of the firm.

James Seffel & Company, Springfield, Ohio, manufacturers of turbines, waterwheels, etc., have announced the removal of their Boston office from 161 Devonshire Street to the Little Building, 80 Boylston Street, Boston.

Hall Brothers Cedar Company, formerly of Jacksonville, Tex., has recently moved to Cœur d'Alene, Idaho, and will engage in the manufacture and wholesaling of western red cedar posts, poles and piling.

The Wise-McClung Manufacturing Company, New Philadelphia, Ohio, has appointed G. B. Gaiennie as general manager of the Sunshine Sales Company, with offices in Cleveland, Ohio.

Commercial Truck Company.—F. F. Espenschied, who represents the Commercial Truck Company, makers of the C-T Electric Truck, in the Pittsburgh territory, has added the local account of the Electric Machinery Manufacturing Company, makers of synchronous motors, alternators and motor-generator sets.

Foreign Trade Notes

FUNDS SECURED TO COMPLETE THE HYDRO-ELECTRIC PLANT ON TEIGIBSCH RIVER, AUSTRIA. — Arrangements have been made by the Steirische Weag Aktien Gesellschaft to secure a loan of 5,000,000 francs from a Swiss banking group, which will enable it to complete the hydro-electric station now in course of construction on the Teigibsch River and to begin work on other hydro-electric projects in its program.

A MODEL ELECTRICAL FARM IN SWEDEN. — To encourage the use of electricity in agriculture, a model electrical farm, according to *Commerce Reports*, is being established near Stockholm, Sweden, and demonstrations of electrically operated plows, harrows, harvesters, threshing machines, churns, separators, etc., will be given.

MANUFACTURE OF INCANDESCENT LAMPS IN NORWAY.—The rights of the Osram patent (German) for Norway, *Commerce Reports* states, have been acquired by a new company. Existing plants have been modernized so that they are now capable of producing 5,000 lamps daily, which is sufficient to supply the Norwegian trade. The factory is under the supervision of workers brought from Germany and the lamps are said to be exact replicas of the German product.

INVESTIGATIONS OF WATER-POWER PROJECTS IN BELGIAN CONGO.—Investigations are now being made by hydro-electric engineers, according to *Commerce Reports*, of the possibilities of two large water-power projects in the Katanga district of the Belgian Congo. One is a 60,000-70,000-hp. project on the Lualaba River, and the other a 50,000-hp. development on the Lufira River. The latter includes a mass-concrete intake dam and an earthen reservoir dam 17 m. high. The schemes are as yet only in the project stage.

ELECTRIC SIGNS IN LILLE, FRANCE. —Electric advertising signs, unknown in 1921 and even late in 1922, have appeared in various parts of the business centers of Lille, France, according to a report of Vice-Consul J. G. Finley to the Department of Commerce. The development of electric sign advertising is becoming noticeable in France and should lead to a market for American waterproof sockets and sign appliances in all important commercial and industrial centers of that country.

Foreign Trade Opportunities

TELEPHONE INSTALLATION IN COLOMBIA.—A new telephone system has been installed in Barranquilla, Colombia. A long-distance line to Cartagena and a new system in Cali is proposed. The system in Barranquilla was installed by an American company.

ELECTRIC PLANT TO BE INSTALLED AT ITARSI, INDIA.—The Itarsi (India) Industrial Corporation, according to *Commerce Reports*, will require an electric plant to supply electricity to the town of Itarsi and to furnish power for driving saws.

CONCESSION ASKED TO INSTALL A TELEPHONE SYSTEM IN BRAZIL. — Application has been made to the Secretary of Public Works of the State of Rio Grande do Sul by Argentine interests, *Commerce Reports* states, for a concession to install a telephone system in the city of Uruguayana and join it with the systems in the municipalities of Quarahy, Alegrete and Livramento.

NEW TELEPHONE SYSTEM PROPOSED FOR REVAL, ESTHONIA.—The telephone system in Reval, Esthonia, is to be enlarged to provide for 2,500 subscribers. The present system is of the old Russian type, and the Post Administration proposes to install two automatic stations, each to have a capacity of 500 telephones. The plans provide for 10,000 telephones eventually. An item of 35,800,000 marks (approximately $105,000 at the present rate of exchange) is included in the national budget for 1923, now before the State Assembly, for such construction.

ELECTRIC PROJECTS IN SPAIN. — Plans are being prepared by the Co-operative de Flúido Electrico of Barcelona for supplying electricity in the Barcelona district. The company proposes to utilize the falls on the River Cadi and coal from its own mines. Several Asturian coal companies, it is announced on the Bourse, have formed a group with a capital of 4,550,000 pesetas, of which 3,100,000 is contributed by the Duro-Felguera concern, to generate electricity by utilizing coal of an inferior quality. The initial capacity of the project will be 5,100 kw., to be supplied by the Duro-Felguera Company.

ELECTRICALLY DRIVEN PUMPING EQUIPMENT FOR BUENOS AIRES. — Tenders will be received by the Department of Sanitary Works, Buenos Aires, Argentina, until April 26 for nineteen groups of vertical centrifugal pumps with electric motors and spare parts.

New Apparatus and Publications

ARMATURE AND FIELD TESTERS.—The Century Electrical Company, 100 Randall Avenue, Syracuse, N. Y., is distributing a folder describing the "Century" armature tester and also a booklet covering the "Century" field tester for testing fields and armatures.

MOVING SIGN. — The American Sign Company, Kalamazoo, Mich., has brought out a new moving sign, known as the "Roto-Sign."

ELECTRIC CLOTHES DRIER.—The Airo Electric Appliance Company, Columbia Building, Pittsburgh, is manufacturing the "Airo" electric clothes drier.

REEL FOR PORTABLE ELECTRIC TOOLS.—Forbes & Myers, 172 Union Street, Worcester, Mass., have placed on the market a reel for use with portable electric tools.

ANGLE AND STRAIGHT CONNECTORS.—The Sprague Electric Works of General Electric Company, 527 West Thirty-fourth Street, New York City, have designed a new duplex Y-shaped connector made in both the straight and 90-degree-angle types.

STEAM-POWER PLANTS. — "Steam Power" is the title of a booklet distributed by the J. G. White Engineering Corporation, 43 Exchange Place, New York City, which describes and illustrates some of the more important steam-power plants which have been built by the corporation.

INDUCTION FURNACE.—Bulletin No. 2 issued by the Ajax Electhrothermic Corporation, 636 East State Street, Trenton, N. J., describes the "Ajax-Northrup" high-frequency induction furnace.

SURGE ARRESTERS.—Bulletin No. 4-A distributed by the Electric Service Company, Marietta, Ga., covers the "Bennett" surge arresters and disk gaps.

BATTERY CHARGER. — A new small battery-charging set has been developed by the Ohio Electric & Controller Company, 5900 Maurice Avenue, Cleveland.

PORTABLE WELDING GENERATORS. —The Alexander Milburn Company, 1416-1428 West Baltimore Street, Baltimore, has recently placed on the market a portable acetylene welding generator, designed to obviate the use of high-pressure cylinders.

BELL-RINGING TRANSFORMER. — A new bell-ringing transformer has been developed by the Killark Electric Manufacturing Company, St. Louis.

SINGLE-PHASE MOTORS.—Bulletin No. 131 issued by the Wagner Electric Corporation, St. Louis, gives instructions for ordering and adjusting repair parts for the "Wagner" single-phase repulsion induction motors.

COKE PLANT MACHINERY. — Leaflet 1,867 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes electrical equipment for coke-plant machinery.

New Incorporations

THE BURKE POWER COMPANY, Morgantown, N. C., has been incorporated with a capital stock of $1,000,000 by A. M. Kistler and others to develop water power in that section.

THE ILLINOIS POWER & LIGHT CORPORATION, 122 South Michigan Avenue, Chicago, has been incorporated with a capital stock of $1,000 by A. C. Winters, H. W. Snell and M. G. Grover.

THE MANUFACTURERS' POWER CORPORATION, Rome, N. Y., has been incorporated by H. T. Dyett, H. D. Wolfe and E. L. Spriggs. The company is capitalized at $50,000 and proposes to generate electricity. M. J. Larkin, Rome, is attorney.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS. — The Edison Electric Illuminating Company will commence work at once on the construction of a power plant on Summer Street, to cost about $500,000.

BOSTON, MASS. — The Gillette Safety Razor Company, 41 West First Street, will install electric power equipment in its proposed factory addition on Dorchester Avenue, to cost about $200,000. Charles T. Main, 49 Federal Street, is architect and engineer.

NORTH ABINGTON, MASS.—The Electric Light & Power Company of Abington and Rockland is arranging for a stock issue of $136,000, part of the proceeds to be used for extensions, etc.

FAIR HAVEN, CONN.—The Ward Baking Company will build a power house in connection with a proposed local baking plant, to cost about $250,000. C. B. Comstock, 110 West Fortieth Street, New York City, is architect and engineer.

LYME, CONN.—The Eastern Connecticut Power Company, Norwich, is negotiating for the purchase of the property of the Lyme Electric Company and a controlling interest in the Danielson & Plainfield Gas & Electric Company.

NEW HAVEN, CONN.—The Connecticut Power Company will soon begin work on an addition to its power house on Grand Avenue, to cost about $25,000, exclusive of machinery.

Middle Atlantic States

LOCKPORT, N. Y.—The City Council has awarded the Lockport Light, Heat & Power Company a contract for street lighting for a period of three years, to furnish a minimum of 705 lamps. In addition the company was given a contract to install seventy-two new lamps on Main Street in the business section.

MALONE, N. Y. — Seventy additional 400-cp. single-lamp standards will be erected on five residential streets this year. The Malone Light & Power Company furnishes the street-lighting service. S. G. Hunter is operating manager.

MASSENA, N. Y. — The plant of the Beakes Dairy Company, including its power house, was damaged by fire recently, causing a loss of about $100,000.

NEW YORK, N. Y.—The New York Edison Company will build a three-story substation at 127 East 120th Street, to cost $85,000.

PENN YAN, N. Y.—The Yates Electric Light & Power Company has applied to the Public Service Commission for permission to erect a new generating station at Cascade Mill, to cost about $500,000.

WATERTOWN, N. Y. — Bonds to the amount of $415,000 have been voted to develop the water power at Delano Falls.

NEWARK, N. J. — The Department of Public Affairs, City Hall, contemplates the erection of an addition to the power station at the city alms house.

NEWARK, N. J. — The Public Service Electric Company will reconstruct a portion of its transmission system in different parts of the state, changing from two-phase to three-phase system.

PHILLIPSBURG, N. J.—The New Jersey Power Corporation has been organized by W. S. Barstow & Company, 50 Pine Street, New York, with a capital of 25,000 shares of stock, no par value, to construct and operate a power plant and system in this section. It will be operated in conjunction with the New Jersey Power & Light Company, Dover.

ASHLEY, PA.—The installation of an ornamental lighting system on Main Street is under consideration by the Borough Council.

FREEBURG, PA.—The Freeburg Power & Light Company, recently organized, contemplates the installation of a local distributing system. A transmission line will be erected. C. M. Walter, Allentown, is treasurer.

HAZLETON, PA.—The Jeddo Highland Coal Company is planning to build a power house at its No. 2 Highland Colliery, to replace the one recently destroyed by fire.

HOLTWOOD, PA. — The Pennsylvania Water & Power Company has issued $450,000 in bonds, the proceeds to be used for extensions to its hydro-electric power plant, comprising two units, each 19,000 hp., on the Susquehanna River.

PHILADELPHIA, PA. — Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 20 for 5,000 ft. electric wire for use at the local navy yard. (Schedule 584.)

PITTSBURGH, PA.—The Press Publishing Company, 228 Oliver Avenue, will install electric motors and other power equipment in its proposed newspaper-publishing plant at Seventh Avenue and Bigelow Boulevard, to cost about $800,000.

YORK HAVEN, PA.—The York Haven Power Company has acquired property on the Susquehanna River for extensions to its power dam and generating station.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company is arranging funds to the amount of $6,500,000 for extensions and improvements during the present year.

CHARLESTON, W. VA.—The Virginian Power Company is considering the construction of a hydro-electric plant on the New River, near Hinton, to cost about $300,000.

BRISTOL, VA.—The Big Jack Overall Company, Inc., Lee and Water Streets, contemplates extensions to its power house.

NORFOLK, VA. — The Pender Grocery Company will install motors and other electric power equipment at its proposed baking plant at Twenty-fifth Street and Fawn Avenue, to cost about $125,000.

SUFFOLK, VA. — The America Brick Corporation will build a substation in connection with its proposed new brick-manufacturing plant.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until March 16 for 12,000 dry batteries. (Circular PR 14,085-1 CP.)

North Central States

ALBION, MICH. — P. E. Ganson, local manager of the Consumers' Power Company, has submitted a proposal to the City Council offering to install a new street-lighting system, to cost about $26,000.

BAY CITY, MICH.—Bids will be received at the office of the W. H. Reid, city manager, City Hall, until March 12 for furnishing and installing electric lighting systems and power wiring in pumping station and filtration plant. Bids will also be received at the same time for one 5,000,000-gal.-per-minute motor-driven centrifugal pump, complete with connecting piping, and for two 10,000,000-gal.-per-minute steam turbo-centrifugal pumps with condenser and auxiliaries. The Frazier-Ellms-Sheal Company, B. F. Keith Building, Cleveland, is engineer.

DETROIT, MICH.—Roehm & Davison, Mack Avenue, will install electric power equipment in the proposed addition at their iron and steel works, Mack and Beaufaite Avenues, to cost about $100,000.

AKRON, OHIO.—Electric lamps will be placed on the High Level Bridge, the expense to be paid by the city.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until March 16 for one 600-hp. steam turbine for the Fairmount pumping station.

CLEVELAND, OHIO. — The Teachout Company, Prospect Avenue, manufacturer of sash, doors, etc., will install motors and other electric equipment in the proposed addition to its plant, to cost about $250,000.

WASHINGTON C. H., OHIO.—Plans are being prepared by the Washington Gas & Electric Company for extensions to its plant, including the installation of new equipment.

DECATUR, IND.—Extensions and improvements will be made in the municipal light and power plant and waterworks, including the installation of additional machinery, to cost about $40,000.

FORT WAYNE, IND. — The Indiana Service Corporation has issued $1,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

INDIANAPOLIS, IND. — The Burnet-Binford Lumber Company, 1401 West Thirtieth Street, contemplates extensions to its power plant, including the installation of boilers, etc.

CHICAGO, ILL.—The Marquette Cement Company, 140 South Dearborn Street, will install electric power equipment in a new building, to be erected at Elston and Redfield Streets, to cost about $260,000.

CHICAGO, ILL.—The Pullman Company, 79 East Adams Street, will install electric power equipment in its car shops, to be erected at Cottage Grove Avenue and 103d Street, to cost about $150,000.

SPRINGFIELD, ILL.—The installation of an ornamental lighting system on Noble Avenue from South Grand Avenue to Laurel Street is under consideration by the City Council.

AMERY, WIS.—The Wisconsin Hydro-Electric Company has acquired the electric light and power plants in Poskin, Hillsdale and Dallas. The company will extend its lines to these communities and establish a twenty-four-hour service.

FOND DU LAC, WIS.—The City Council has authorized the installation of a new fire-alarm system, to cost $7,000.

MANITOWOC, WIS.—The City Council has authorized the Board of Public Works to secure estimates for extensions and remodeling the municipal electric light and power plant, to include the installation of the following equipment: One 2,000-kw. turbine, to replace a 300-kw. unit; two 4,000-hp. boilers; one 2,000-hp. feed-water heater, duplex pump, mechanical stokers, complete switchboard equipment and auxiliaries.

MARKESAN, WIS. — Plans are being prepared by the River View Canning Company for the construction of a canning factory and power house, to cost about $50,000.

NEENAH, WIS.—Preliminary plans are being prepared by Cahill & Douglas, engineers, 217 West Water Street, Milwaukee, for a power house, 60 ft. x 160 ft., for the Valley Paper Mills.

OWEN, WIS.—The Wisconsin-Minnesota Light & Power Company is planning to erect a high-tension transmission line from Owen to Curtiss.

PESHTIGO, WIS. — The Northeastern Power Company, a subsidiary of the Wisconsin Public Service Corporation, Green Bay, is planning to erect a new transmission line between Peshtigo and the Air Line Road.

WAUKESHA, WIS.—The installation of an ornamental lighting system in the business district is under consideration by the City Council.

BRAINERD, MINN.—Bids, it is reported, will soon be asked for a 200-hp. engine and generator for the waterworks pumping station. L. P. Wolff, Guardian Life Building, St. Paul, is engineer.

ST. PAUL, MINN. — The Ford Motor Company, Detroit, Mich., has been granted permission by the Federal Power Commission to construct a hydro-electric power plant at the High Dam, Mississippi River, to be used in connection with a proposed local automobile and tractor plant, to cost about $2,000,000.

DAVENPORT, IOWA.—The substitution of a single-unit street lamp for the present five-lamp electroliers is under consideration by the light committee of the City Council.

ROCHESTER, IOWA.—Plans have been prepared by the Iowa Railway & Light Company, Cedar Rapids, for the construction of a hydro-electric plant and dam on Cedar Rapids at Rochester. Three plans are under consideration: (1) a five-unit plant, 22-ft. head, to cost $1,317,000; (2) an eight-unit plant, 22-ft. head, to cost $1,551,000; (3) an eight-unit plant, 27-ft. head, to cost $1,963,000.

MARTHASVILLE, MO. — The Marthasville Electric Light & Power Company, recently organized, is preparing plans for a electric light and power system.

KANORADO, KAN. — The Council has awarded a contract to the Goodland (Kan.) Light & Power Company to furnish electricity in Kanorado. Bonds to the amount of $25,000 were recently voted to erect a transmission line and distributing system.

Southern States

CHARLOTTE, N. C. — An electrically operated pumping plant will be installed in the proposed municipal filtration plant and waterworks, to cost about $300,000.

COCOA, FLA.—The plant of the Cocoa Ice & Light Company has been acquired by the Southern Utilities Company, Palatka. Improvements, it is said, will be made to the system.

MARIANNA, FLA.—The Marianna Light & Power Company has started work on the construction of a power plant on the Chipola River in Marianna. G. M. Thomas is interested in the company.

LIVINGSTON, TENN.—The Cumberland Power Company, which recently acquired the local plant, plans to erect a transmission line to Rock Island, a distance of 25 miles, to connect with its water-power plant.

ALBERTVILLE, ALA. — The municipal electric plant and waterworks system has been acquired by the Alabama Water Company, which will make improvements to same.

CITRONELLE, ALA. — The Citronelle Light & Power Company contemplates building an ice-manufacturing and cold-storage plant.

RIVER FALLS, ALA.—The Public Service Commission has granted the River Falls Power Company permission to build a hydro-electric plant on the Conecuh River, near River Falls.

CORINTH, MISS.—The City Council contemplates an expenditure of about $200,000 for municipal improvements, including electric light plant, waterworks and street work.

POPLARVILLE, MISS.—The Love Lumber Company plans to rebuild its power house and lumber mill, recently destroyed by fire, causing a loss of about $100,000.

RAYNE, LA.—Bids will be received by the Mayor and the Council of Rayne at the office of the city clerk until March 20 for improvements to the municipal electric light plant and waterworks system, including the construction of power house, two 200-hp. or one 300-hp. oil-engine generator unit, one three-panel or one two-panel switchboard, one deep well, one 750-gal.-per-minute deep-well centrifugal pump and motor, one air lift system for pump, cast-iron pipe, etc. The J. B. McCrary Company is engineer.

MUSKOGEE, OKLA. — The Oklahoma General Power Company is planning to erect an addition to its local steam-driven plant, increasing the output by 20,000 hp., to cost about $1,000,000.

SAND SPRINGS, OKLA.—Electric power equipment will be installed in the new plant of the Sand Springs Cotton Mill Corporation, to cost about $115,000.

WYNNEWOOD, OKLA.—The Texas Pacific Refining Company will install electric power equipment at its proposed local oil refinery.

FORT WORTH, TEX.—The installation of a street-lighting system in the Rosen Heights district is under consideration.

HOWE, TEX.—Plans for the proposed new waterworks system call for the installation of electrically operated pumping machinery.

PANHANDLE, TEX.—Plans have been completed for the construction of a transmission line for local light and power service.

STAMFORD, TEX. — The West Texas Utilities Company has completed plans for the construction of a local power plant for auxiliary service, to cost about $400,000.

Pacific and Mountain States

ANACORTES, WASH.—Plans are being prepared by the E. K. Wood Lumber Company for the erection of a new mill, with power plant and machine shop, at Burrows Bay, to cost about $400,000.

OLYMPIA, WASH.—The County Commissioners have granted the Olympia Light & Power Company permission to extend its lines into the Pleasant Glade district to furnish electrical service.

QUINCY, WASH. — The Washington Water Power Company plans to erect a 13,000-volt transmission line from Moses Lake to Quincy (20 miles) to supply electricity for irrigation purposes to the orchards around Quincy.

SEATTLE, WASH.—Work will soon be started on the erection of the 105-mile transmission line from the Skagit River (municipal) hydro-electric project to Seattle. C. F. Uhden is chief engineer of the work.

TACOMA, WASH.—Plans are under consideration by the Municipal Electric Light Department for the erection of a substation on the Wapato Hill reservoir site to distribute electricity in the South Tacoma district.

VANCOUVER, WASH. — The Columbia River Paper Mills, Inc., is preparing plans for its proposed new plant, including power house, to cost about $500,000.

ALBANY, ORE.—Extensive improvements are contemplated by the Mountain States Power Company, including the erection of a transmission line from Prospect to Springfield. The cost of the work is estimated at about $200,000.

INDEPENDENCE, ORE.—The Mountain States Power Company plans the erection of a transmission line from Albany to Independence, to cost about $60,000.

KLAMATH FALLS, ORE.—The California-Oregon Power Company contemplates erecting a 66,000-volt transmission line from Algoma to Chiloquin, a distance of 22 miles, to serve the latter town and the sawmills in that district.

METOLIUS, ORE.—The Federal Power Commission has granted the Columbia Valley Power Company a preliminary permit for the development of the Metolius power site.

CONCORD, CAL.—The Pacific Gas & Electric Company contemplates extending its transmission lines into the Concord Burgess district, east of the town.

DAVIS, CAL.—The Pacific Gas & Electric Company, San Francisco, has acquired a site in Davis on which it will erect a power house, machine and repair shop and other buildings, to cost about $100,000.

LE GRAND, CAL. — The San Joaquin Light & Power Corporation, Fresno, plans to erect a 70,000-volt transmission line in this section. A new substation will be built for service in the eastern sections of Merced and Madera Counties.

LIVERMORE, CAL.—Bids will be received by the director of the United States Veterans Bureau, Arlington Building, Washington, D. C., until March 29 for the construction of a tuberculosis Hospital at Livermore, including all buildings, heating, ventilating, electric work, etc.

LOS ANGELES, CAL.—An ordinance is being arranged for the installation of an ornamental street-lighting system on Arden Boulevard, Third Street and El Centro Avenue.

LOS ANGELES, CAL. — The California Cyanide Company has been organized by the officials of the Air Reduction Corporation, 342 Madison Avenue, New York City, and F. W. Braun of the Braun Corporation, New High Street, Los Angeles, to erect a plant here for the production of sodium of cyanide and kindred products, to cost about $500,000. The proposed work will include a power house and machine shop.

NEWMAN, CAL.—The National Ice & Cold Storage Company will install electric power equipment at its proposed ice-manufacturing plant, to cost about $100,000.

PORTERVILLE, CAL.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system on Main Street.

SACRAMENTO, CAL.—Plans are under consideration for the installation of fire and police signal-alarm systems.

SAN FRANCISCO, CAL. — The Pacific Gas & Electric Company is preparing plans for the construction of five substations in different parts of the city, to cost about $800,000.

TRACY, CAL.—The Chamber of Commerce is securing estimates of cost for the installation of an ornamental lighting system on Central Avenue and Sixth Street.

BOISE, IDAHO.—Plans have been completed by the Idaho Power Company for extensions to its power plant on the Snake River at American Falls, to cost about $1,000,000. The work will include an addition to power house and the installation of two new generating units having a total capacity of 17,000 hp.

CHANDLER, ARIZ. — An election will soon be held to vote on the proposal to issue bonds for the installation of a municipal electric distribution system and an ornamental street-lighting system. It is proposed to purchase energy to operate the system.

GRAND JUNCTION, COL. — Arrangements are being made by the Grand Junction Electric, Gas & Manufacturing Company for resetting a 268-hp. Heine boiler in reinforced-steel concrete boiler frame and for erecting a new fireproof power house. A. E. Anderson is general superintendent.

Canada

ST. JOHN, N. B. — New tenders, it is stated, will be asked by the City Council for switching equipment and for heating and lighting the civic substation.

LONDON, ONT.—The erection of 18 to 20 miles of rural transmission lines in London Township is under consideration by the Public Utilities Commission.

WALKERVILLE, ONT.—The local Hydro-Electric Commission has petitioned the Town Council for an appropriation of $25,000 for extensions to the system. Plans have been approved by the Town Council for the installation of electric lamps on Wyandotte Street, to be maintained by underground wires, to cost about $12,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Feb. 13, 1923)

1,445,589. LOCK; K. Horiguchi, Tokyo, Japan. App. filed July 9, 1921. Magnetic lock.

1,445,600. ELECTRIC HEATER; J. Lavoie, Montreal, Can. App. filed Nov. 25, 1921. Combined cooking unit and room heater.

1,445,610. ADJUSTABLE HIGH RESISTANCE; C. P. Brockway, Toledo, Ohio. App. filed June 14, 1920. High-resistance shunt across the condenser located in series with grid electrode of audion.

1,445,613. DETECTOR; H. P. Donle, Meriden, Conn. App. filed April 6, 1922. Contact-type detector for radio signaling.

(Issued Feb. 20, 1923)

1,445,636. METHOD OF AND MEANS FOR INDICATING THE FREQUENCY ALTERATIONS OF AN ALTERNATING CURRENT; A. Meissner, Berlin, Germany. App. filed May 3, 1922. Apparatus for measuring radio frequencies.

1,445,640. POLE-CARRYING RING FOR ELECTRIC APPARATUS; T. E. Murray, Jr., and J. B. Murray, Brooklyn, N. Y. App. filed April 6, 1921. Stamped sheet metal with segments welded together.

1,445,644. MATERIAL FOR THE PRODUCTION OF CARBIDE; J. H. Reid, Pittsburgh, Pa. App. filed Oct. 23, 1919. Calcium-oxy-compound and cokable carbonaceous material reduced in electric furnace.

1,445,645. PROCESS OF AND MATERIAL FOR THE PRODUCTION OF METAL HYDRATES AND FOR THE PRODUCTION OF GAS; J. H. Reid, Readsboro, Vt. App. filed Jan. 27, 1921. Coke from gas retort reduced in electric furnace.

1,445,665. ELECTRIC LIGHTING FIXTURE; E. L. Dales, Philadelphia, Pa. App. filed March 9, 1922. Reflector over end of lamp and one around lamp.

1,445,678. RHEOSTAT; A. C. Gilbert, New Haven, Conn. App. filed Jan. 28, 1918. Designed for base of electric fan.

1,445,706. ELECTRIC HEATER; A. Papini, Philadelphia, Pa. App. filed Oct. 15, 1919. Vacuum chamber on rear of reflector prevents escape of heat.

1,445,707. CIRCUIT CONTROLLER FOR ELECTRIC HEATERS; A. Papini, Philadelphia, Pa. App. filed Oct. 15, 1919. Device opens circuit when pedestal occupies any position other than normal

1,445,731. TRANSMISSION SYSTEM; H. J. Van Der Bijl, New York, N. Y. App. filed Sept. 30, 1918. Three-electrode tube combined with two-electrode tube for amplifying radio signals.

1,445,759. MEANS FOR AND METHOD OF TESTING MULTIPLEX CARRIER CIRCUITS; J. Davidson, Jr., Montclair, N. J. App. filed Sept. 25, 1919. Testing the transmission efficiency of apparatus.

1,445,811. APPARATUS FOR EXHAUSTING INCANDESCENT ELECTRIC LAMPS AND SIMILAR ARTICLES; M. P. Wetmore, Newark, N. J. App. filed Nov. 5, 1918. Rotary air pumps on rotating table successively place evacuated lamps before operator.

1,445,829. TELEPHONE REST; C. Fischer, New York, N. Y. App. filed July 21, 1921. Attachable arm for holding receiver to ear.

1,445,855. TROLLEY-WIRE FROG; G. D. Slaymaker, Detroit, Mich. App. filed Jan. 12, 1922. Provided with adjustable renewable runners.

1,445,860. APPARATUS FOR TREATING METALS; J. S. Turek, Cicero, Ill. App. filed May 13, 1921. Electric furnace of tilting type used for refining, melting or heat-treating metals.

1,445,885. COMMUTATOR; A. J. Hix, Hellier, Ky. App. filed July 13, 1922. Method of soldering leads to segments.

1,445,896. VARIABLE INDUCTANCE; M. C. M. Lane, Roselle Park, N. J. App. filed June 2, 1922. Combines all functions of variometer, variocoupler and variable inductance.

1,445,897. ELECTRIC HEATER; E. N. Lightfoot, New York, N. Y. App. filed March 8, 1920. Resistor enclosed by and insulated from sheet metal armor.

1,445,919. ELECTRICAL COIL UNIT; D. Stone, New Rochelle, N. Y. App. filed March 25, 1922. Movable end attachment to secure accurate resistance value.

1,445,924. ELECTRICAL CONNECTOR; R. E. Williams and H. H. Moreton, Los Angeles, Cal. App. filed April 9, 1920. For lamps, spotlights, and similar devices.

1,445,929. ELECTRICAL APPARATUS; W. R. G. Baker, Schenectady, N. Y. App. filed Oct. 7, 1920. Wireless transmission system employing two electron tubes.

1,445,933. DYNAMO-ELECTRIC MACHINE; J. L. Burnham, Schenectady, N. Y. App. filed July 19, 1920. Poles in which magnetic material not only carries magnetic flux but also exciting current.

1,445,961. ELECTROLYSIS APPARATUS; P. M. Kree, New York, N. Y. App. filed Oct. 15, 1918. Depilatory apparatus.

1,445,967. CIGAR LIGHTER; J. C. Lehmann, Jamaica, and G. H. Timmerman, Brooklyn, N. Y. App. filed Jan. 13, 1922. Induction coil spark used to ignite wick.

1,445,978. STATIONARY INDUCTION APPARATUS; H. O. Stephens, Pittsfield, Mass. App. filed April 30, 1921. Electric furnace transformer with multiple connected windings.

1,445,988. METHOD AND APPARATUS FOR RECTIFYING HIGH-TENSION ALTERNATING CURRENT; G. A. Witte, Philadelphia, Pa. App. filed April 8, 1919. Mechanical device operated in synchronism with alternating current makes and breaks connection between supply circuit and load, giving unidirectional impulses.

1,445,992. CUTTING MACHINE; J. S. Cameron, Montreal, Canada. App. filed Sept. 24, 1921. Prongs electrically heated to temperature that will cut through material without tearing.

1,446,005. ROTARY CONVERTER; H. F. T. Erben, Schenectady, N. Y. App. filed Oct. 17, 1913. Method by which commucating field strength may be automatically adjusted.

1,446,029. LIQUID-TREATING INSTRUMENT; F. E. Beidler, New York, N. Y. App. filed Sept. 9, 1921. Electric heater for small receptacles

1,446,106. CONTACT SHOE FOR THE THIRD RAIL OF ELECTRIC CARS; W. A. U. Seltzer, Philadelphia, Pa. App. filed Nov. 25, 1922. Shoe provided with side roller member engaging beneath or upon third-rail.

1,446,133. RAILWAY SIGNAL LANTERN; P. J. Sloan, Denver, Colo. App. filed Dec. 27, 1921. Electric lantern with differently colored bulbs.

1,446,135. INSULATOR; L. Steinberger, Brooklyn, N. Y. App. filed March 15, 1917. Pin-type insulator with four petticoats.

1,446,153. METHOD OF MAKING HIGH-SPEED STEEL; W. B. Brookfield, Syracuse, N. Y. App. filed Dec. 29, 1920. Subjecting material to continuous heat of electric furnace.

1,446,166. VARIOMETER; C. R. Dumble, Arlington, Mass. App. filed July 24, 1922. Spherical type.

1,446,170. ELECTRIC ARC WELDING MACHINE; J. W. Fay, Milwaukee, Wis. App. filed March 25, 1920. Two arcs operated in welding joint or seam, one being used for welding one portion of the seam and the other for welding remaining portion.

1,446,182. CLOCK; W. A. Hicks, Cincinnati, Ohio. App. filed May 10, 1921. Electrically operated clock.

1,446,234. THERMOTELEPHONIC RECEIVER; A. Williams and L. D. Williams, London, England. App. filed April 24, 1920. Arrangement of metal foil improved.

1,446,246. MEANS FOR RECORDING AND REPRODUCING SOUND; L. de Forest, New York, N. Y. App. filed Sept. 18, 1919. Sound waves recorded on photographic film similar to motion-picture film.

1,446,317. ELECTRICAL LIQUID HEATER; W. Penzold, Hanover, Germany. App. filed May 22, 1922. Electric steam generators.

1,446,318. SYSTEM FOR ELECTRICALLY HEATING LIQUIDS; W. Penzold, Hanover, Germany. App. filed Aug. 5, 1922. Liquid heated by electric current flowing through it.

1,446,385. AIRCRAFT LANDING STATION; E. C. Hanson, Washington, D. C. App. filed March 5, 1919. Radio compass signal system to guide airplanes in flight and in landing.

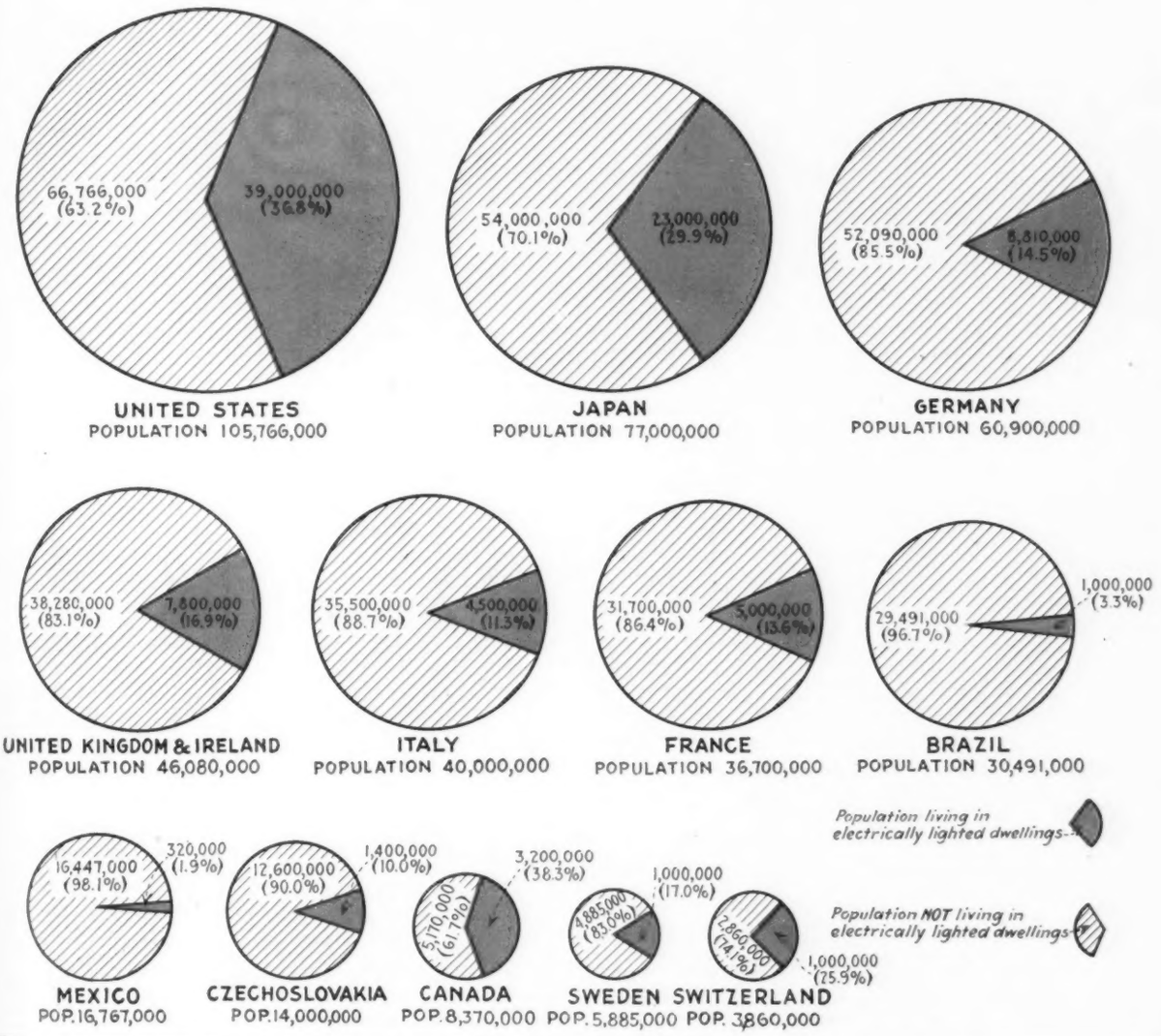
1,446,433. CIRCUIT ARRANGEMENT FOR INDICATING THE DEVIATION OF A SENDER FROM A DESIRED FREQUENCY; W. Schaffer, Berlin, Germany. App. filed Aug. 3, 1922. For wireless transmitting work.

1,446,436. MACHINE SYNCHRONIZING SYSTEM; F. Stevens, Philadelphia, Pa. App. filed Sept. 30, 1920. Means for controlling speed relations between any driven machine and one or more other independently driven machines intended to be operated in conjunction.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

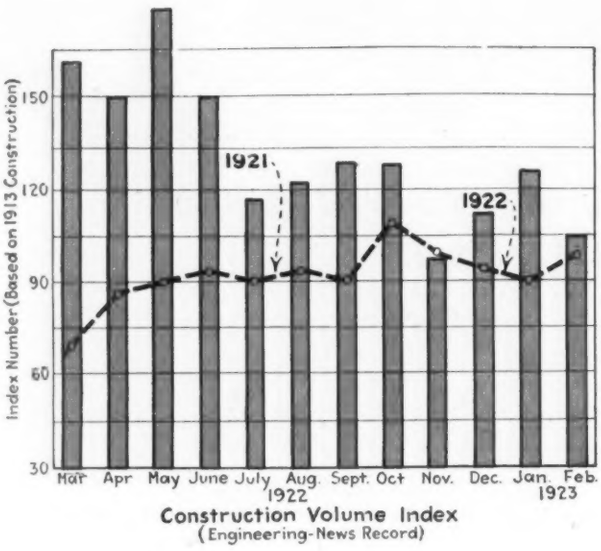
Only 111,822,000, or 6.5 per Cent, of the World's Population Live in Electrically Lighted Dwellings



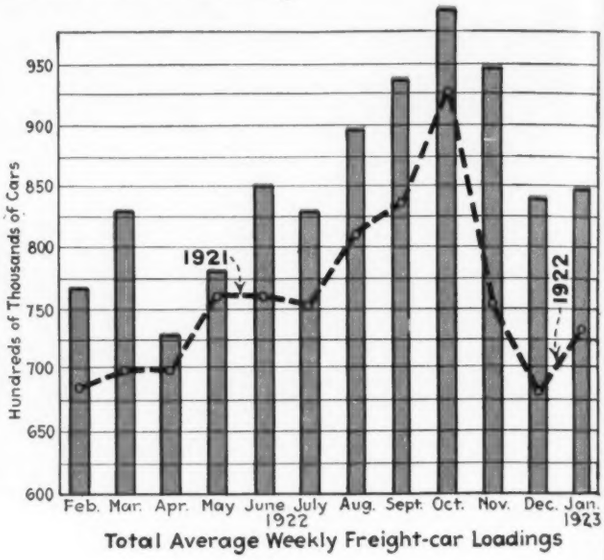
A Test of Civilization

DEGREE of civilization is judged by certain standards. One of these is the extent to which home life has been developed. The general adoption of home comforts and domestic labor-saving devices places a nation upon a high plane of civilization. This is particularly true of the use of electrical energy in the home. Nations which are recognized as the leaders in modern civilization will be found to be rated high in the percentage of their inhabitants living in electrically lighted dwellings. Such peoples have at their beck and call a source of comfort in the way of light, heat and power which has a strong tendency to elevate the mental and moral standards of the community. It may be stated with confidence that the central station bids fair to be one of the greatest civilizers in the world's history.

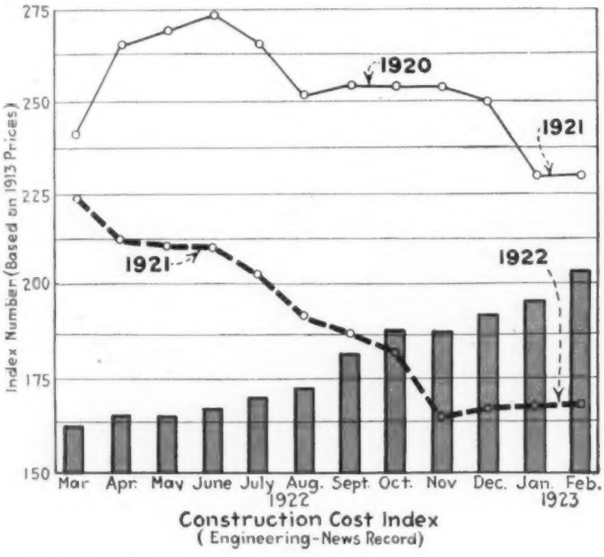
How the Primary Industries Are Trending



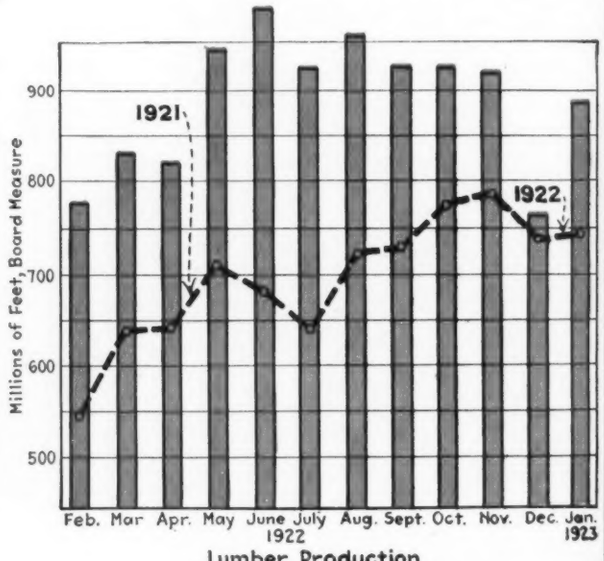
Construction Volume Index
(Engineering-News Record)



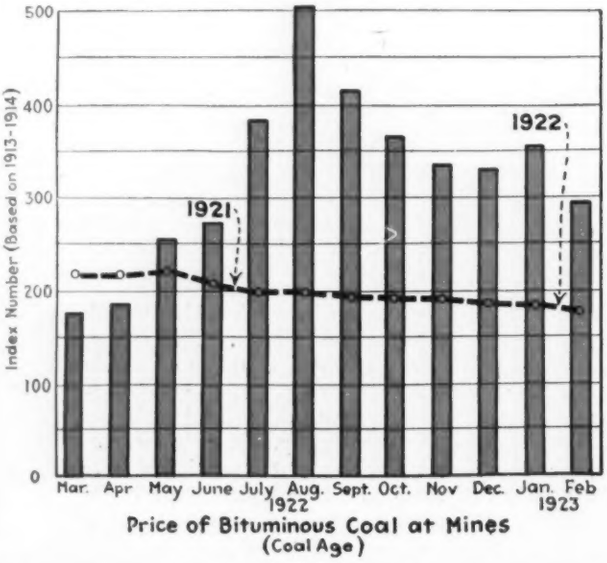
Total Average Weekly Freight-car Loadings



Construction Cost Index
(Engineering-News Record)



Lumber Production
(Yellow Pine and Douglas Fir)



Price of Bituminous Coal at Mines
(Coal Age)

The Rise in Construction Costs

THE gradual rise in the cost of construction materials which has taken place during the past eleven months is playing a large part in holding back the rapid return to normal industrial conditions. Many construction projects which last fall appeared certain of realization in 1923 are being held up on account of the excessively high cost of material and labor. In February the cost of general construction was 26.4 per cent above that of March last year and was only 25.2 per cent under the high record figure of June, 1920. A very large part of this is due to the increased wages demanded by labor, but the cost of construction material has also shown a decided upward trend. What effect this adverse condition will have on the sales of electrical apparatus and supplies as well as on new consumers of electrical energy is problematical, but it is a condition which will bear careful watching by the industry.